Comprehensive Wastewater Treatment Facilities Plan

Task 2: Cost-Effectiveness of Alternative Technologies

LEON
FLORIDA'S CAPITAL COUNTY

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ACRONYMS AND ABBREVIATIONS

ANSI	American National Standards Institute
ATU	aerobic treatment unit
AWTS	alternative wastewater treatment system
BMAP	Basin Management Action Plan
CWTFP	Comprehensive Wastewater Treatment Facilities Plan
DEP	Florida Department of Environmental Protection
ETV	Environmental Technology Verification
F.A.C.	Florida Administrative Code
gpd	gallons per day
INRB	in-ground nitrogen-reducing biofilter
JSA	Jim Stidham and Associates
kW	kilowatt-hours
mg/L	milligrams per liter
NPDES	National Pollutant Discharge Elimination System
NWFWMD	Northwest Florida Water Management District
NSF	National Sanitation Foundation
NSILT	Nitrogen Source Inventory and Loading Tool
O&M	operation and maintenance
OSTDS	onsite sewage treatment and disposal system
PBTS	performance-based treatment system
PFA	priority focus area
ROW	right-of-way
RME	Responsible Management Entity
USEPA	U.S. Environmental Protection Agency
WSWT	wettest season water table
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

Leon County is developing a plan to reduce nitrogen loads from existing onsite sewage treatment and disposal systems (OSTDSs) to groundwater and surface waters. OSTDSs are also known as septic systems. The plan also considers nitrogen load reduction associated with treatment alternatives for future development. The Florida Department of Environmental Protection (DEP) found that nutrient loads from several sources—including OSTDSs in Leon County—impaired the Upper Wakulla River and Wakulla Spring. Leon County's plan has two parts: (1) a comprehensive wastewater treatment facilities plan for the entire county, and (2) a more focused facilities plan for the part of the county that loads nitrogen to the Wakulla River and Wakulla Spring. Objectives of the plan are (1) to identify OSTDSs to transition to alternative wastewater treatment systems where the transition will most reduce nitrogen loads to surface waters and groundwater, and (2) to identify locations of future development that require alternative wastewater treatment systems to reduce nitrogen loads to surface waters and groundwater.

Leon County is preparing the plan by progressing through eight major tasks. This report describes the results of the second task. This task includes quantifying nitrogen reduction alternative costs; estimating nitrogen load reduction, as a mass, for each alternative; and quantifying the cost-effectiveness of each alternative, as a function of both direct costs to households and community benefits from improved water quality.

The purpose of this plan is to identify appropriate alternative wastewater treatment systems (AWTSs) to provide nutrient reductions in areas of Leon County that are identified as contributing to the Upper Wakulla River and Wakulla Spring. By upgrading existing traditional OSTDS to AWTSs and planning for the use of AWTS in future development, nutrient loading to these sensitive and important waterbodies can be reduced, thereby improving water quality. The estimated nutrient reductions presented in this plan were calculated using the methods that DEP developed for the Upper Wakulla River and Wakulla Spring Nitrogen Source Inventory and Loading Tool (NSILT) and Basin Management Action Plan (BMAP). While the actual load reductions achieved may not match these estimates exactly, the most important consideration is that using AWTSs in place of traditional OSTDS will reduce nutrient loading.

This Task 2 report includes the following preliminary findings:

Finding 1. Costs for OSTDSs are significant when calculated as a separate component of new construction and the expected, annualized costs of drainfield replacement are included.

Finding 2. In-ground nitrogen-reducing biofilters have the least cost per pound of nitrogen removed because these biofilters do not require hardware, electricity for equipment operation, annual maintenance, or annual monitoring.

Finding 3. Active systems are more cost-effective per pound of nitrogen removed than OSTDSs. Active systems include aerobic treatment units and performance-based treatment systems.

Finding 4. Different types of active cluster systems have similar benefit-cost ratios due to economies of scale and relatively greater total nitrogen removal rates. A performance-based treatment system is one example of an active cluster system.

Finding 5. Connection to a centralized wastewater collection system is the most expensive option if all costs are paid by the developer or property owner. Centralized wastewater collection systems are also known as central sewers. Central sewers reduce nitrogen loads to groundwater more than other alternatives. If central sewer construction is funded by a municipal utility, central sewer is more attractive than other alternatives.

Finding 6. Clustered systems, whether active or passive, appear more cost-effective than individual systems where costs for land for the treatment system and drainfield are part of the business model. Land dedicated for this purpose during the design of a subdivision, while still part of development costs, can offset or eliminate the individual share of this expense. Cluster systems can offer efficiencies of scale for capital and operating costs.

Finding 7. The benefit-cost ratio of central sewer improves only marginally (0.08) if the connection fee is subsidized fully by a grant.

These Task 2 findings are preliminary and subject to refinement as development of Leon County's plan progresses.[1]

[1] Per the January 6, 2021 email discussion between Jim Stidham and Associates (JSA) and DEP, the scope of Task 2 does not include consideration of costs to address capacity upgrades of existing central wastewater treatment facilities. Prospective limitations of capacity beyond the 20-year horizon of this study could affect wastewater treatment options, and the cost and funding considerations of planning, designing, and constructing additional capacity should be evaluated by the County's wastewater utility providers.

1.0 Introduction

The Florida Department of Environmental Protection (DEP, 2018) found that nutrient loads from several sources impaired water quality in the Upper Wakulla River and Wakulla Spring. To develop a plan to restore the river and spring, DEP calculated the maximum amount of nitrate that the river and spring can receive, while still satisfying water quality standards. This maximum amount is called a total maximum daily load (TMDL). DEP prepared the Upper Wakulla River and Wakulla Spring Basin Management Action Plan (BMAP) to restore the river and spring by identifying actions that will reduce pollutant loads to the river and spring. DEP adopted the BMAP in June 2018 and requires that stakeholders, including Leon County, reduce nitrogen loads to the river and spring from onsite sewage treatment and disposal systems (OSTDSs). OSTDSs are also known as septic systems. An OSTDS is composed of a septic tank and a drainfield. Leon County contracted with Jim Stidham and Associates (JSA) to develop the plan to reduce nitrogen loads from OSTDSs. JSA partnered with Advanced Geospatial, Applied Technology & Management (ATM), The Balmoral Group, Magnolia Engineering, and Tetra Tech to create the plan. JSA and these partners are referenced throughout this plan as the JSA team.

The Leon County plan has two parts: (1) a comprehensive wastewater treatment facilities plan (CWTFP), and (2) a more focused facilities plan for the part of the county governed by the BMAP. The CWTFP is funded through a grant from the Blueprint Intergovernmental Agency. DEP funded the BMAP facilities plan with a grant to the county. About 40% of Leon County is served by OSTDS, about 20% is served by five wastewater treatment facilities, and about 40% is government land that will not likely be developed during the next few decades and will not likely require wastewater treatment (Figure 1). Areas within the Tallahassee city limits are not included in these percentages.

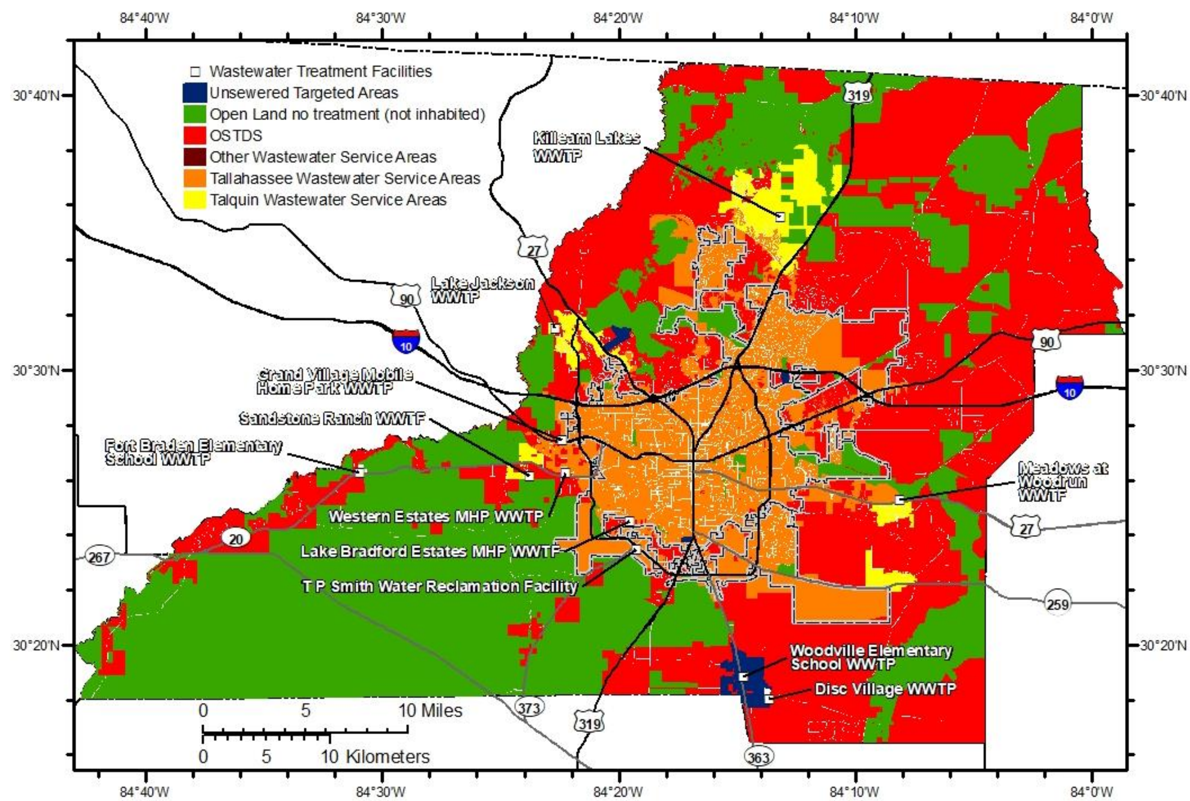

__Figure 1.__ Parcels with OSTDS, five wastewater treatment facilities or wastewater treatment plants, the City of Tallahassee wastewater service area, and the Talquin Electric Cooperative service area.

The objective of Leon County's plan is to identify existing OSTDSs to transition to alternative wastewater treatment systems (AWTSs), where the transition will most reduce nitrogen loads to the river and spring. To accomplish this objective, the JSA team is performing the following tasks:

Task 1. Develop a nitrogen reduction score to identify likely contribution of nitrogen from OSTDSs to groundwater and surface waters; use the score to quantify, rank, and identify OSTDSs to transition to AWTSs; and establish nitrogen reduction criteria for AWTSs for each of the separate delineated unsewered target areas (Completed)

Task 2. Quantify cost-effectiveness of AWTSs

Task 3. Identify other factors that influence selection of an AWTS

Task 4. Provide education to the community regarding information compiled in Tasks 1 through 3 and survey the citizens of Leon County for their opinions of this plan

Task 5. Analyze implementation scenarios for AWTSs

Task 6. Calculate the anticipated decrease in nitrogen load to the Upper Wakulla River and Wakulla Spring, between 2020 and 2040, due to OSTDS transition to AWTSs

Task 7. Provide additional education to the community regarding the information compiled in Tasks 1 through 7 and conduct an additional survey of the citizens of Leon County for their opinions of this plan

Task 8. Present the plan to the Leon County Board of County Commissioners

This report describes Task 2 of the Leon County plan: evaluate the cost-effectiveness of AWTSs.[2] In this report, the JSA team describes the objectives of Task 2 (Section 1.1), summarizes data used to evaluate cost-effectiveness (Section 2.0), presents the draft results of the cost-effectiveness evaluation (Section 3.0), and provides the preliminary findings of the evaluation (Section 0).

1.1 Task 2 Objectives

The objective of Task 2 is to evaluate the cost-effectiveness of AWTSs. Cost is a function of a target percent reduction in nitrogen load. This report summarizes data used to determine costs and nitrogen load reduction efficiency for each AWTS, as compared to OSTDS. The following AWTSs were evaluated as part of Task 2:

- In-ground nitrogen-reducing biofilters (INRBs) – These systems include a reactive media layer consisting of wood mulch, sawdust, or other organic material mixed with sand under a drainfield so that effluent in the drainfield percolates through the reactive media.
- Aerobic treatment units (ATUs) – In these systems, effluent passes through an aeration stage prior to discharge to the drainfield. This system is mechanical, with a blower to aerate and sometimes to recirculate the effluent.
- Performance-based treatment systems (PBTS) – In these systems, effluent passes through two stages of treatment: (1) nitrification, and (2) one or more stages of denitrifying media. This system can also include active recirculation.
- Cluster systems – These are wastewater treatment systems designed to serve two or more dwellings or facilities with multiple owners. These systems require land and a system manager. They may include INRBs, ATUs or PBTSs.

In addition, the JSA team evaluated the cost of connecting wastewater services to a centralized wastewater collection system, where a collection system exists. The nitrogen reduction for a centralized wastewater collection system is 95%, which is based on the advanced wastewater treatment level for the City of Tallahassee's Thomas P. Smith Water Reclamation Facility. The Talquin Electric Cooperative Wastewater Treatment Plants (WWTPs)

[2] Lombardo Associates (2011) addressed life-cycle costs for select nitrogen removal technologies and was used as reference in the thinking and development of the current study. The data in the Lombardo Associates report are at least nine years old (and select data were dated 2009 and not inflation adjusted), do not reflect current conditions, and do not include all options within this current study. This study includes the latest data, conditions, and treatment options since the Lombardo Associates study.

achieve an estimated 65% nitrogen reduction, which was not used in Section 3.0 (Cost-Effectiveness Evaluation) of this task of the study.

Traditional OSTDSs that are properly sited, designed, constructed, maintained, and operated are generally considered a safe means of disposing domestic wastewater and reducing pathogens. However, these systems are not designed to remove nutrients from wastewater. Where available, connecting existing OSTDS to a central wastewater collection system is the most effective option to reduce nutrient loading. Where central wastewater collection is not a feasible option, ATUs, PBTSs, INRBs, or cluster systems provide an opportunity to improve the nutrient removal efficiency of an onsite treatment system.

The purpose of this plan is to identify appropriate AWTSs to provide nutrient reductions in areas of Leon County that are identified as contributing to the Upper Wakulla River and Wakulla Spring. By upgrading existing traditional OSTDSs to AWTSs and planning for the use of AWTSs in future development, nutrient loading to these sensitive and important waterbodies can be reduced, thereby improving water quality. The estimated nutrient reductions presented in this plan were calculated using the methods that DEP developed for the Upper Wakulla River and Wakulla Spring Nitrogen Source Inventory and Loading Tool (NSILT) and BMAP. While the actual load reductions achieved may not match these estimates exactly, the most important consideration is that using AWTSs instead of traditional OSTDSs will reduce nutrient loading.

1.2 Treatments Options Evaluated

The JSA team evaluated the OSTDS and the following three primary categories of AWTSs:

- Advanced (Onsite) Wastewater Treatment
  - ATUs
  - PBTSs
  - INRBs
- Cluster Systems
  - ATUs
  - PBTSs
  - INRBs
- Centralized Wastewater Collection Systems
  - Pressure
  - Gravity

The following subsections describe each system.

1.2.1. Onsite Sewage Treatment and Disposal Systems

The basic OSTDS (Figure 2) is the base case for the cost-effectiveness element of Task 2; all other options are compared with the OSTDS, including lifetime costs, nitrogen load reduction, and cost per pound of nitrogen removed. The basic OSTDS consists of a standard septic tank and drainfield, with no aeration or further treatment of the effluent. The combined septic system, drainfield, and underlying soil processes reduce total nitrogen load by approximately 50%.

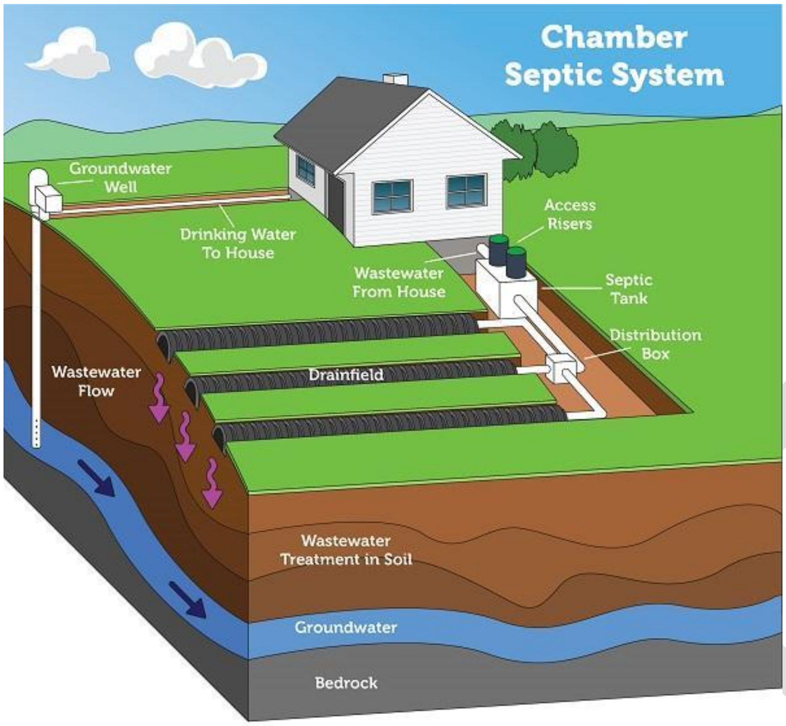

Figure 2. *OSTDS design and nitrogen processes, from [https://www.epa.gov/septic/types-septic-systems.](https://www.epa.gov/septic/types-septic-systems)*

1.2.2. In-Ground Nitrogen-Reducing Biofilters

An INRB (Figure 3) is a passive upgrade to an OSTDS. INRBs do not require electrical components, such as pumps and aerators. An INRB drainfield is a two-stage, passive biofilter based on ammonification and nitrification in the first stage and denitrification in the second stage. OSTDSs or cluster systems that employ a passive INRB drainfield reduce total nitrogen load by 65%[3] relative to OSTDS alone. The drainfield for an INRB can be implemented using various approaches: lined, non-lined, gravity-feed, low-pressure dosed, and others. The Florida Department of Health approved system with a gravity-fed non-lined drainfield is being used for this study. OSTDS upgrades to INRB can incorporate the OSTDS for pre-treatment and to buffer effluent discharge. INRBs require certain soil conditions and are not suitable for all areas. The presence of an INRB must be recorded in the public record as notification to any future property owners. However, they do not require an engineered design, maintenance contract, or operating permit from the county health department.

[3] Hazen & Sawyer. 2015. Florida Onsite Sewage Nitrogen Reduction Strategies Study.

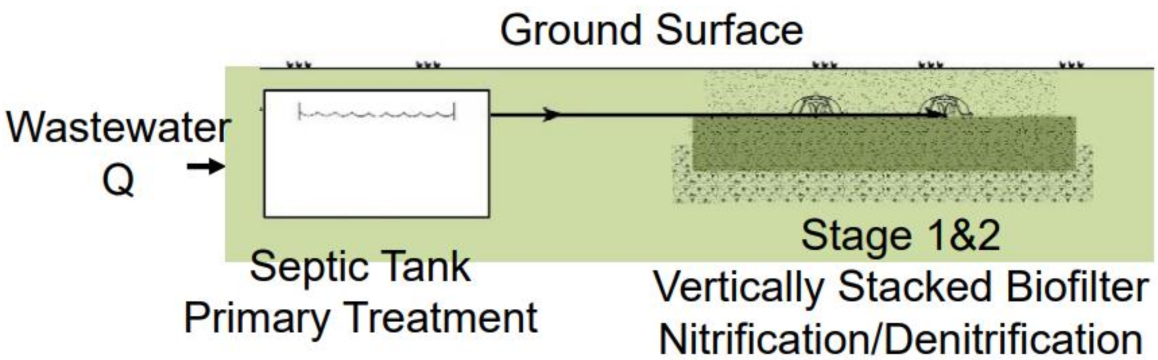

***Figure 3**. Typical passive INRB design, from In-ground Nitrogen-Reducing Biofilter, Florida Department of Health, Bureau of Environmental Health, August 2018.*

1.2.3. Aerobic Treatment Units

ATUs are a significant share of the AWTS market. ATUs are active systems and have been used in Florida and elsewhere for nearly 30 years where an OSTDS fails to address wastewater treatment requirements and standards, especially for pathogens.[4] These systems include powered recirculation or some other method of decreasing nitrogen concentrations.

Per the Florida Department of Health, ATUs designed to treat up to 1,500 gallons of sewage per day must be certified to National Sanitation Foundation (NSF) and American National Standards Institute (ANSI) Standards 40, 245, or 350 by a third-party certifying program.[5] ATUs must be designed by an engineer and require a maintenance contract and operating permit from the county health department. These systems must be certified by NSF International and be capable of providing, on average, at least 50% nitrogen reduction for ATUs and 90% reduction under test conditions before (partially) treated wastewater is discharged to the drainfield. In compliance with Rule 64E-6 of the Florida Administrative Code (F.A.C.), when these systems are installed with less than 24 inches between the bottom of the drainfield and the seasonal high water table, the system must be capable of reducing nitrogen by at least 65% before discharge to the drainfield (Figure 4).[6]

[4] Department of Health and Rehabilitative Services, Onsite Sewage Disposal System Research in Florida (1993).
[5] Per the 2015 Florida Department of Health report to the Governor: "Aerobic treatment units (ATUs) are complex mechanical and energy intensive units that add air to the sewage so that oxygen demanding compounds in the sewage can be digested before the sewage enters the drainfield. Aerobic treatment units are permitted based on a standardized technology test by a third-party that certifies that the technology functions in removing oxygen demanding compounds and solids. ATUs are required to have lifetime operating permits and monitoring and maintenance by an approved maintenance entity."
[6] DEP BMAP nitrogen-reducing requirements differentiate between systems that have 24 inches of separation between the bottom of the drainfield and the wettest season water table (WSWT) and those that do not. Existing systems (modifications/repairs) installed with less than 24 inches of water table separation between the bottom of the drainfield and the WSWT (as allowed per Rule 64E-6) must use systems that are capable of at least 65% nitrogen removal. New systems and modifications/repairs installed with at least 24 inches between the bottom of the drainfield and the WSWT may use any system capable of at least 50% nitrogen removal to comply with future BMAP requirements.

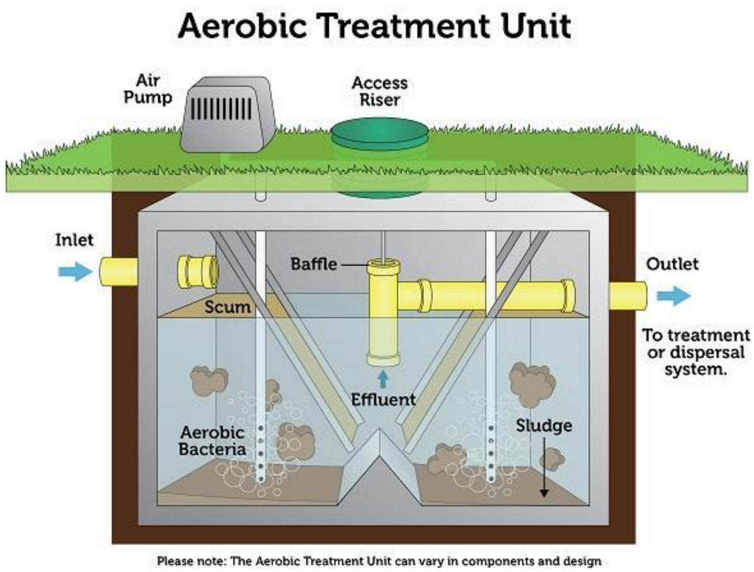

Figure 4. *Typical ATU design, from [https://www.epa.gov/septic/types-septic-systems.](https://www.epa.gov/septic/types-septic-systems)*

1.2.4. Performance-Based Treatment Systems

PBTSs dominate the AWTS market and are active systems. Since about 1990, PBTSs have been used where OSTDSs do not satisfy wastewater treatment requirements and standards, especially for pathogens.[7] PBTSs include (powered) recirculation or some other method of reducing nitrate concentrations.[8]

PBTSs must be designed by an engineer and require a maintenance contract and operating permit from the county health department. PBTSs must be certified by NSF International and be capable of providing, on average, at least 50% nitrogen reduction (and 90% reduction under test conditions) before partially treated wastewater is discharged to the drainfield. In compliance with Rule 64E-6, F.A.C., when these systems are installed with less than 24 inches between the bottom of the drainfield and the seasonal high water table, these systems must be capable of reducing nitrogen by at least 65% before discharge to the drainfield (Figure 5).

[7] Department of Health and Rehabilitative Services, "Onsite Sewage Disposal System Research in Florida" (1993).
[8] Per the Florida Department of Health (2015), PBTSs are a type of OSTDS that has been designed to meet specific performance criteria for certain wastewater constituents as defined by Chapter 64E-6.025(10), F.A.C. Nitrogen is only one of the possible constituents in wastewater that can be addressed by a PBTS. Other constituents that may be addressed include carbonaceous oxygen demand, total suspended solids, total phosphorus, or fecal coliforms as a pathogen indicator. Technologies used in a PBTS can have a range of complexity and energy intensity. Under current market conditions, most technologies used in PBTSs have been based on aerobic treatment units and include active aeration, where air is introduced into the sewage.

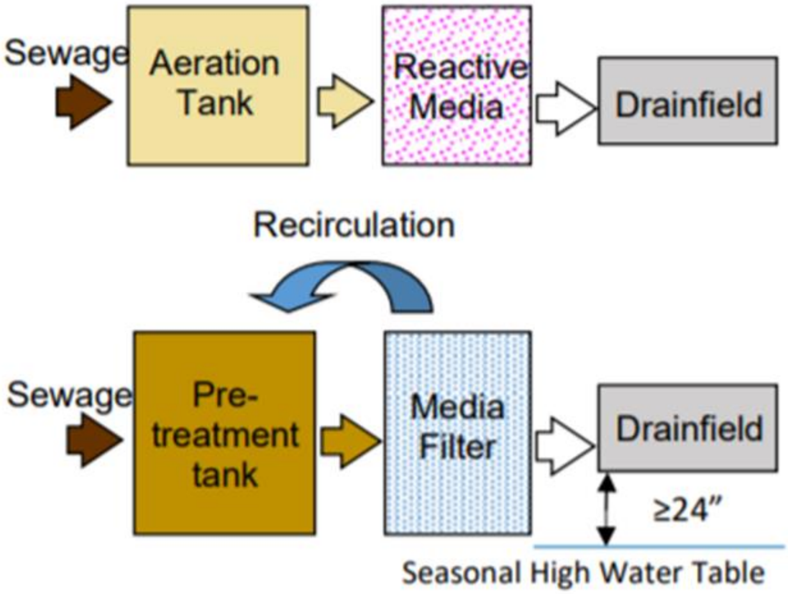

Figure 5. *Typical PBTS design (using either ATU or recirculation), from [http://www.floridahealth.gov/environmental-health/onsite-sewage/products/_documents/bmap-n-reducing-tech-18-10-29.pdf.](http://www.floridahealth.gov/environmental-health/onsite-sewage/products/_documents/bmap-n-reducing-tech-18-10-29.pdf)*

1.2.5. Cluster Systems

Cluster systems (Figure 6) are an alternative to individually owned and operated OSTDSs or connection to a centralized wastewater collection system. Cluster systems are also referred to as small community, decentralized wastewater collection systems. Decentralized treatment is emphasized under this option and may include any of the passive or active AWTS options described in Sections 1.2.2, 1.2.3, and 1.2.4.[9] The size of these decentralized systems ranges from serving as few as two units to several dozen. The U.S. Environmental Protection Agency (USEPA) notes that such systems are common in rural subdivisions.[10] Septic tanks, new or existing, are used to initiate denitrification and to provide buffering capacity for the cluster system, equalizing rates of flow among contributing units and thereby providing a more consistent and predictable waste product.

For purposes of this evaluation, *passive* cluster systems are assumed to rely solely on INRB technologies, with similar treatment effectiveness, such as a 65% reduction in nitrogen load. The key differences between individual and clustered INRBs relate to efficiencies of scale for the biofiltration components and drainfields. However, depending upon configuration, these potential savings may be offset by land and easement costs.

For purposes of this evaluation, *active* cluster systems may rely on ATU or PBTS that can support as many as 16 households. The collection network considerations for either passive or active cluster systems are identical and, for the scales of service contemplated, are assumed to be driven by the forces of gravity.

The benefit-cost analysis includes an assessment of both passive and active cluster systems. The determination of a preferred option, depending on target area, will be part of Task 5 of this study.

[9] Active cluster systems could use package plants, which are pre-manufactured facilities used to treat wastewater in small communities or on individual properties. Typically, such plants are designed to treat flow rates that range from 2,000 gallons per day (gpd) for about 10 homes to 0.5 million gallons per day. Most commonly, they treat flows rates between 0.01 and 0.25 million gallons per day (i.e., from 25 to 600 units). However, a package plant would be classified as a WWTP and would be required to be permitted as such. A package plant would also require a WWTP operator. Therefore, for the purposes of this project, package plants were not evaluated; the central wastewater alternative is intended to include only connection to either existing City of Tallahassee or Talquin utilities.
[10] https://www.epa.gov/septic/types-septic-systems#cluster.

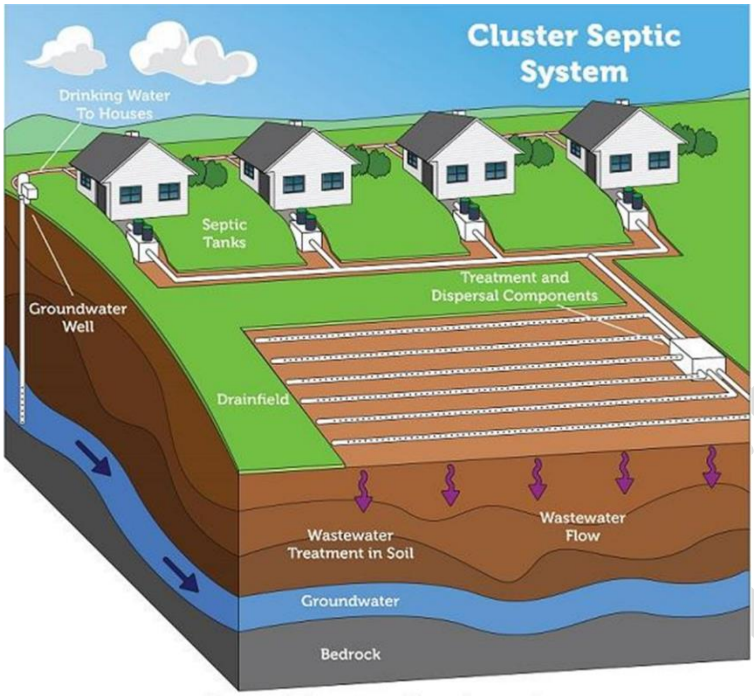

Figure 6. *Typical cluster design, from [https://www.epa.gov/septic/types-septic-systems.](https://www.epa.gov/septic/types-septic-systems)*

1.2.6. Gravity Centralized Wastewater Collection Systems

Centralized wastewater collection systems are also known as central sewers. The Task 1 report considered centralized wastewater disposal alternatives based on the method of effluent disposal:

- Rapid infiltration basin
- Reuse, primarily via irrigation
- Spray field irrigation

For the evaluation of cost-effectiveness as an alternative to an OSTDS, rather than being defined by choice of effluent disposal as in Task 1, centralized wastewater collection systems are defined in Task 2 by their proximity to existing service networks: (1) those that adjoin or are sufficiently close to tie into existing service (City of Tallahassee or Talquin) using gravity, without the need for a lift station; and (2) those that are too remote from existing service and will require one or more lift stations.[11] Gravity centralized wastewater collection systems (Figure 7) transmit wastewater to treatment facilities by gravity flow alone and do not include pumps to force wastewater with pressure to the facility.

The analysis for a gravity collection system does not directly address the incremental costs for expanding central treatment facilities or for extending existing service lines within either the city or the Talquin sewer service areas (see Section 2.3.6). The Task 3 report documents existing treatment capacity. Extension of service is a policy consideration, and costs cannot be allocated to individual units without specification of locations of service.

[11] An evaluation of the costs associated with expansion of existing WWTPs was not included within this study. Exclusion of consideration of WWTP expansion applies to both gravity (Section 1.2.6) and pressure (Section 1.2.7) systems.

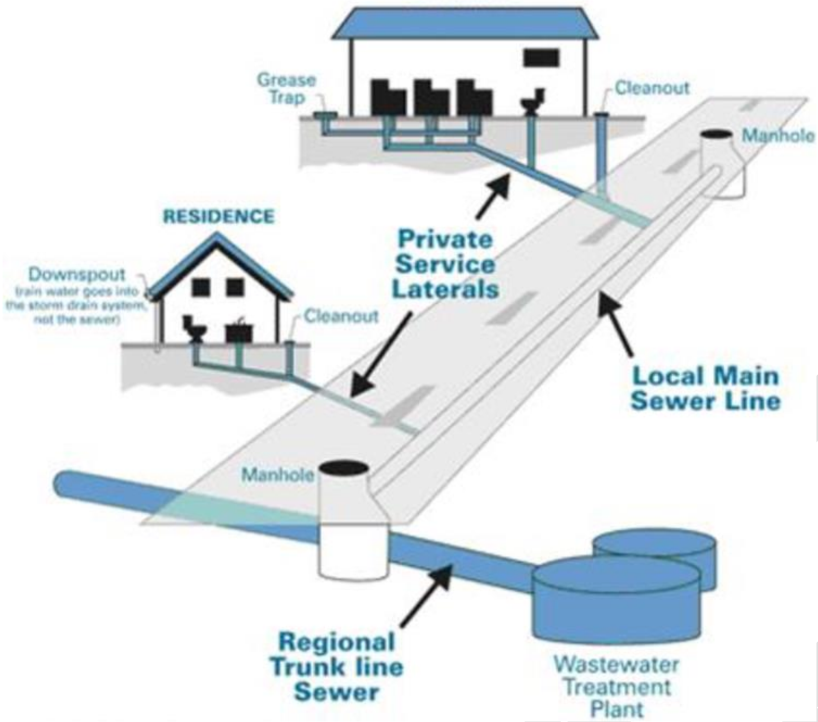

Figure 7. *Gravity centralized wastewater collection system, from* https://www.tn.gov/content/dam/tn/environment/water/documents/study_1203.pdf.

1.2.7. Pressure Centralized Wastewater Collection Systems

A pressure centralized wastewater collection system includes lift stations and force mains to deliver wastewater to treatment facilities. Pressure centralized wastewater collection systems (Figure 8) will be required where retrofit or new development is not adjacent to an existing collection system, and either distance or variable topography necessitates pumping of septage. Lift stations or pumps, force mains or pressurized pipes, and the length of the run to connect to existing service are significant cost factors, increasing the cost per new unit served. The exclusion of incremental costs for centralized wastewater system expansion is addressed in Section 1.2.6.

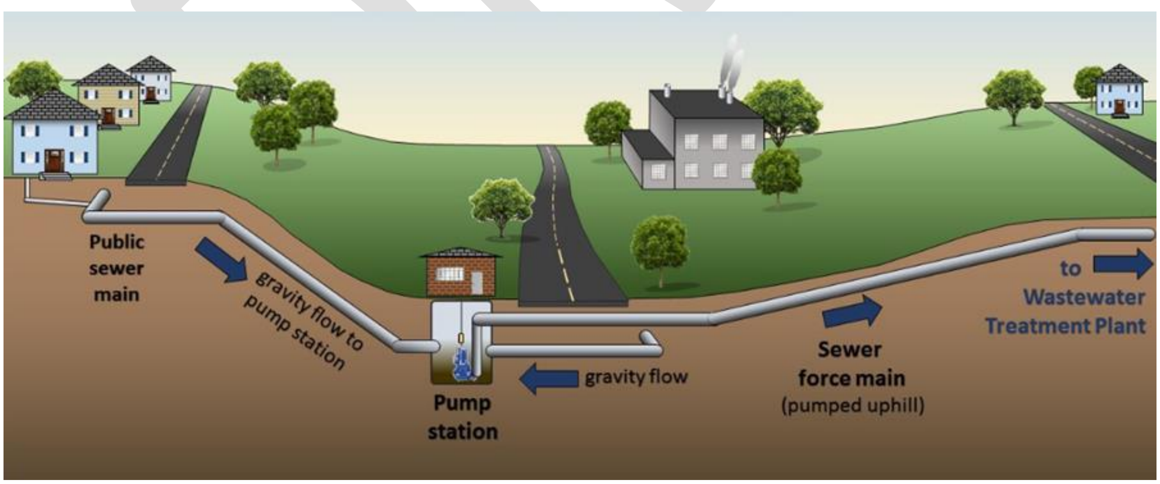

Figure 8. *Pressure centralized wastewater collection system, from https://www.trentonnj.org/447/Wastewater-Treatment.*

2.0 Data Summary

Detailed costs and references for the several options considered are included in the appendices. The cost analysis herein, especially for installation and operations, is intended to be general for the study area as a whole. Ultimately, these discrete cost elements may vary depending upon the levels of nitrogen removal to be achieved within any target area. Consequently, such refinements to costs will be reflected in later phases of this study, where treatments are matched with site conditions, opportunities, and constraints.

2.1 Design and Permitting Expenses

Design and permitting costs include typical expenses for engineering and obtaining the appropriate permits for installation from local and state government.

2.1.1 Onsite Sewage Treatment and Disposal Systems

Design costs for OSTDSs are integral to the construction costs described in the following sections and are generally not broken out as a discrete entry. The permitting cost through the Leon County Health Department for an OSTDS is $360. This cost is separate from any site evaluation costs incurred and typically charged under construction/installation. The Florida Department of Health can perform this service, which costs $150 in Leon County (2018). Plumbing permit fees, under the county's Department of Development Support and Environmental Management are $91.38 for issuance plus $8.51 per unit (about $100 total). Total permitting costs are $610 per unit.

2.1.2 In-Ground Nitrogen-Reducing Biofilters

The permitting cost through the Leon County Health Department for an individual INRB is $360. Plumbing permit fees are $91.38, plus $8.51 per unit—or about $100. The site evaluation cost as described under OSTDS is assumed to be $150. Total permitting costs are $610 per unit.

2.1.3 Aerobic Treatment Units

Design costs for ATUs are integral to the construction costs described below and are generally not broken out as a discrete entry. The permitting cost through the Leon County Health Department for an individual ATU is $360. This cost is separate from any site evaluation costs, which are typically charged under construction/installation. Plumbing permit fees are $91.38, plus $8.51 per unit—or about $100. Site evaluation cost, per above, is assumed to be $150. Total permitting costs are $610 per unit.

2.1.4 Performance-Based Treatment Systems

Design costs for PBTSs are integral to the construction costs described below and are generally not broken out as a discrete entry. However, PTBSs must be designed by a Florida-licensed engineer. The permitting cost through the Leon County Health Department for an individual PBTS is $360. This cost is separate from any site evaluation costs, which are typically charged under construction/installation. Plumbing permit fees are $91.38, plus $8.51 per unit—or about $100. The site evaluation cost, per above, is assumed to be $150. Total permitting costs are $610 per unit.

2.1.5 Cluster Systems

There are no unique permitting costs for cluster systems. These permitting fees will represent service connections reviewable by the Leon County Health Department and are assumed to be $360 per unit. Plumbing permit fees are $91.38, plus $8.51 per unit: the plumbing permit cost for an eight-unit system is $159. Site evaluation cost, per above, is assumed to be $150 for the one application (and not per unit). Total permitting costs for the example of eight units are $3,189, or $399 each. Table 1 illustrates the anticipated economy of scale for the permitting of cluster systems, from an average cost of $489 per unit for two units to an average cost of $384 per unit for 16 units.

Table 1. *Permit costs for cluster systems*

Units	Health Department	Plumbing Permit, Fixed	Plumbing Permit, Variable	Site Evaluation	Total	Average Cost
2	$720.00	$91.38	$17.02	$150.00	$978.40	$489.20
4	$1,440.00	$91.38	$34.04	$150.00	$1,715.42	$428.86
6	$2,160.00	$91.38	$51.06	$150.00	$2,452.44	$408.74
8	$2,880.00	$91.38	$68.08	$150.00	$3,189.46	$398.68
12	$4,320.00	$91.38	$102.12	$150.00	$4,663.50	$388.63
16	$5,760.00	$91.38	$136.16	$150.00	$6,137.54	$383.60

Source: Leon County Health Department; Leon County Department of Development Support and Environmental Management

Based upon other multiple-unit wastewater collection systems, engineering (design) costs for cluster systems, regardless of treatment option, are estimated to be 10% of the construction total (see Section 2.2.5). Costs in Table 1 are intended to address new installation but are applicable to retrofit. Design and permitting expenses for a retrofit would be proportional to system size as constrained by the property available to support the system.

For this study, the use of a cluster system is based on placement on vacant property. For currently established property to be used, the land required would either need to be purchased from the current owner or placed into an easement. The required cost to permit and design the treatment portion of the cluster system would be similar to a typical ATU. Additional costs would be associated with the collection system and right-of-way (ROW) acquisition, in lieu of the typical ATU.

2.1.6 Gravity and Pressure Centralized Wastewater Collection Systems

There are no unique permitting costs for connecting existing or future OSTDSs to the existing centralized wastewater collection system (the City of Tallahassee and Talquin Electric Cooperative). Leon County Health Department fees are not applicable; however, plumbing permit fees for the lateral connection are $91.38, plus $8.51 per unit—or about $100. There are no individual design costs for individual connections. System design costs are included under construction/installation (Section 2.3.6).

2.2 Construction of Treatment System

2.2.1 Onsite Sewage Treatment and Disposal Systems

The typical cost of a 1,000-gallon tank—suitable for a three-bedroom home—is between $2,100 and $9,500, with a median cost of $6,055. The construction costs for a traditional OSTDS include excavation, septic tank, drainfield and installation of all pipe connections. It should be noted that the Upper Wakulla River and Wakulla Spring BMAP prohibits new conventional OSTDS on lots less than one acre within the priority focus areas (PFAs).

2.2.2 In-Ground Nitrogen-Reducing Biofilters

The DEP grant program allows up to $10,000 of reimbursement for the installation of the INRB system and the local contractors had been installing for this price. The cost appears to be weighted based on the funding available and not on the actual cost of installation. The estimated cost to install an INRB system, as part of the most recent bid solicitation, came close to the outside installers' cost.[12] For this reason, the estimate provided by outside installers seems more reasonable as a proxy for a local competitive bid situation. Based on discussions with installers elsewhere (where the grant program is not available), installation cost varies between $6,300 and $6,800. For purposes of this cost-effectiveness analysis, the upper bound of costs—$6,800—is assumed.

[12] The average unit cost of two bids in 2020 to retrofit 90 sites was $8,217, including tank replacement, and mounded drainfields among other site-specific needs.

2.2.3 Aerobic Treatment Units

Based on costs adjusted for year and for Florida (versus elsewhere in the United States), purchase and installation of an ATU will cost $11,889, and adjusted costs ranged from $7,047 to $17,466 for different brands and differently sized models. Installers caution that every site is different.

Costs vary in north Florida, depending on the installer and the system purchased. For example, an AquaKlear 400 gpd system costs $2,805, but the price does not reflect excavation and setup. A Fuji Clean CEN5 system (500 gpd, nitrogen reducing) costs $5,000 for the unit alone, and installation cost is between $7,000 and $10,000.

For purposes of this evaluation, $11,889 is assumed for purchase, delivery, excavation, and installation. Several of the ATUs reviewed made use of an existing drainfield. Consequently, new development will require the inclusion of that cost, estimated to be $4,000, for a total construction cost of $15,889.

2.2.4 Performance-Based Treatment Systems

Based on inflation-adjusted costs for Florida (versus elsewhere in the United States), purchase and installation of an ATU or a PBTS will cost $13,216, and adjusted costs ranged from $9,499 to $17,058 for different brands and differently sized models. Almost all installations reviewed made use of an existing drainfield. Consequently, new development will require the inclusion of that cost, estimated to be $4,000, for a total of $17,216.[13]

As with ATUs (see Section 2.2.3), costs vary in north Florida depending on the installer and the system purchased. Several local vendors provided coarse estimates for purchase and installation, regardless of whether the system was an ATU or PBTS. The primary costs were excavation, installation, and setup, and less so, the system of choice (system sizes being equal).

2.2.5 Cluster Systems

The treatment for cluster systems can be either passive (as an INRB) or active (as an ATU or PBTS). Relative to the treatment construction costs for individual installations, there are economies of scale inherent with cluster systems. For example, for one supplier of active systems (Bio-Microbics), the cost was reduced from $4,000–$5,500 to $3,500, a 26% decrease per unit, when used in a cluster system.[14] A regression of sizes and costs for Fuji Clean CEN systems (adjusted R^2 of 0.97) projects a cost of $39,500 for a 3,000-gallon system (10 units), or $3,950 per unit.[15]

[13] In contrast, the Lombardo Associates study indicated capital costs between $17,800 and $21,000 for a PBTS AWT system. Based on the Consumer Price Index, this range of costs would now be between $20,400 and $24,000. The current market price for purchase and installation costs for these systems has declined significantly.
[14] A package plant (Bioclere™ Model 16/12) for a 27-unit clustered community reported savings of 45% (Washington Department of Health, 2005).
[15] Fuji Clean CEN systems provide greater rates of nitrogen reduction than the system approved by the Florida Department of Health and are more expensive for equivalent capacities.

Table **2** provides Florida dealer/installer costs for one brand of active system (PBTS) approved by the Florida Department of Health that offers multiple sizes capable of handling from 2 to potentially 20 households (at 300 gpd per household).

Table 2. *Capital costs for variably sized performance-based treatment systems*

Units	GPD	Cost	Cost/Unit
1	500	$8,750	$8,750
2	700	$10,000	$5,000
3	900	$14,250	$4,750
3-4	1000	$22,500	$5,625
6	1900	$30,000	$5,000
8-9	2700	$45,000	$5,000
18-20	6000	$99,549	$4,977

Source: Personal communication, Scott Samuelson, Fuji Clean USA on April 22, 2020

While the capital costs for such systems increase with successive sizes, the cost per unit decreases from $8,750 to about $5,000.[16] Economies of scale for system purchase are diminished in this specific instance because of significant shipping expenses. These costs are for the treatment system and do not include the cost of the drainfield.

Separate from raw land costs for the drainfield, the construction costs for cluster INRB systems include the installation of the INRB treatment medium and effluent distribution network in dimensions suitable for the number of units (and gallons) expected. The medium is about one-third of the total costs of installation for a single unit. Based on that relationship, total costs for an 8-unit system are estimated to be $23,000, or $2,875 per unit.

The costs for connections to the cluster system and the drainfield are included in Section 2.3.5 and Section 2.5.5, respectively.

2.2.6 Gravity and Pressure Centralized Wastewater Collection Systems

Construction costs are not assigned directly to the property owner to connect to a centralized wastewater collection system; however, the property must still be connected to the collection network via a private lateral. The cost for laterals varies by the distance between the house outfall and the collector network, and bypassing the existing septic tank, if any, in the case of a retrofit. Typical local (Leon County) cost for such installations on residential lots smaller than one-half acre is about $7,500.

As described in Section 1.2.6, this analysis excludes consideration of incremental or proportional expenses associated with expanding existing WWTPs (or constructing new ones).[17] The one-time connection charge of $4,500 (both City of Tallahassee and Talquin) supports such investments,[18] but the need, timing, and scale of expansion (and any additional associated costs) are beyond the scope of this study. These costs are included under Section 2.3.6 and Section 2.3.7.

2.3 Construction of Collection System and Connections

2.3.1 Onsite Sewage Treatment and Disposal Systems

No collection system is required; discharge is onsite.

[16] The capital costs for the 6,000-gpd CE style unit were estimated via regression.
[17] Per January 6, 2021 email discussion between JSA and DEP, the scope of Task 2 does not include consideration of costs to address capacity upgrades of existing central wastewater treatment facilities. Prospective limitations of capacity beyond the 20-year horizon of this study could affect wastewater treatment options, and the cost and funding considerations of planning, designing, and constructing additional capacity should be evaluated by the County's wastewater utility providers. Further, such costs when established would be utility-wide, or service district-based, and not uniquely attributable to any one installation.
[18] While Section 21-151 of the City of Tallahassee Code of Ordinances describes the use of the sewer systems charge fund "to provide for the capital cost of construction and directly related costs required solely due to growth of the system," such one-time charges offset only a portion of the costs.

2.3.2 In-Ground Nitrogen-Reducing Biofilters

No collection system is required; discharge is onsite.

2.3.3 Aerobic Treatment Units

No collection system is required; discharge is onsite.

2.3.4 Performance-Based Treatment Systems

No collection system is required; discharge is onsite.

2.3.5 Cluster Systems

For purposes of this analysis, the collection system for a cluster system is assumed to be proportional to that of a gravity centralized wastewater collection system, but does not include lift stations or force mains. Table 3 summarizes the cluster system data presented in Appendix G, reflecting the appropriate sizes of pipes and other infrastructure for collection systems smaller than those analyzed in Appendix E, a gravity centralized wastewater collection system serving 51 units.

Table 3. *Collection costs for variably sized cluster systems (cul-de-sac configuration)*

Units	Cost per Unit with Tank Abandonment	Cost per Unit without Tank Abandonment
4	$11,530	$10,580
8	$9,232	$8,283
16	$8,089	$7,139

For collection systems, there are economies of scale, and about a 30% reduction may be expected in cost per unit as the system is expanded from 4 to 16 units served. Costs are provided for systems with and without the abandonment of septic tanks. Costs per unit for a linear configuration, e.g., 8 units per side of ROW, are 13 to 15% greater, respectively, than a cul-de-sac arrangement. For purposes of this benefit-cost analysis, the less costly configuration of 8 units was employed. Tanks are expected to be installed and retained for passive cluster systems relying on INRB, because the effluent requires the tank to filter the solids. Septic tanks will not be required for active cluster systems since the appropriately scaled aerobic treatment unit and other PBTS components will be included in the system. However, in a retrofit cluster system, tanks may be retained to remove solids and to buffer the rates of flow and improve system efficiency.

If an INRB is used for a cluster system, a central septic tank would be needed for collection and treatment of the sewage. This would be required for the regulation of flow to the INRB, particularly if a grinder pump is required. In the selection of a property for the use of a cluster system, the respective grades of the houses to be connected would need to be accounted for and would be used as a method for selection (i.e., gravity versus pressure). If a house does not meet the required grade requirements for the use of gravity flow, then a grinder pump station would need to be installed.

2.3.6 Gravity Centralized Wastewater Collection Systems

Costs of centralized wastewater collection systems vary significantly depending upon whether the system is strictly gravity or requires lift stations and force mains. Appendix E provides a summary of recent bids for a collection system serving 44 units, including costs for gravity components. The construction cost without design but including mobilization and lift-station tie-in for the gravity collection system is $30,558 per unit.[19] The City grant supported connection where a City-operated sewer main was adjacent to the property seeking connection.

[19] Unit costs for the gravity collection system reflect reductions in profit, design, and contingency expenses in addition to the costs of the master pump and force mains.

In addition to the costs of collection, the City of Tallahassee requires a one-time connection fee and tap location fee. Outside the city limits, the Sewer System Charge is $4,500[20] and the tap fee is $275, for a total of $4,775. However, for a limited time, the State of Florida through the City of Tallahassee will fund the entire cost of connecting eligible properties in the county to the city's sewer system.[21] The cost for a new connection to the Talquin Electric Cooperative system varies based on water meter size.[22] The smallest connection fee is $4,500 for the typical three-quarter-inch water service.

2.3.7 Pressure Centralized Wastewater Collection Systems

Appendix F provides a summary of recent bids for a pressured collection system, including costs for pumps, force mains, and associated equipment, for service to 154 properties, the average total cost per unit is $29,771. The per-unit costs for this specific project reflect significant economies of scale relative to the bid for the gravity system described in Section 2.3.6.[23] The City grant supported connection where a City-operated sewer main was adjacent to the property seeking connection.

In addition to the costs of collection, the City of Tallahassee requires a one-time connection fee and tap location fee. Outside the city limits, the sewer system charge is $4,500[24] and the tap fee is $275, for a total of $4,775. However, for a limited time, the State of Florida through the City of Tallahassee will fund the entire cost of connecting eligible properties in the county to the city's sewer system.[25] The cost for a new connection to the Talquin Electric Cooperative system varies based on water meter size.[26] The smallest connection fee is $4,500 for the typical three-quarter-inch water service.

2.4 System (User) Charges

User charges reflect the typical monthly assessments incurred by wastewater treatment system users or beneficiaries. User charges may reflect incremental or marginal operating costs for an individual unit of treatment, such as the monthly cost of effluent volume, or greater costs, such as the sum of a customer's share of a system's administrative and operating costs, lifecycle and replacement costs, amortized costs of land and construction, and other costs.

2.4.1 Onsite Sewage Treatment and Disposal Systems

There are no user system charges for OSTDSs.

2.4.2 In-Ground Nitrogen-Reducing Biofilters

There are no user system charges for INRBs.

2.4.3 Aerobic Treatment Units

There are no user system charges for ATUs.

[20] Tallahassee Land Development Code Sec. 21-151. – Water systems charge fund and sewer systems charge fund established; functions; charges levied.
[21] DEP and the Northwest Florida Water Management District (NWFWMD) awarded $637,000 to connect about 130 properties currently on septic systems to the existing centralized wastewater collection system in the PFA inside the corporate limits of the City of Tallahassee. [https://www.talgov.com/you/seweroverseptic-grantdetails.aspx]
[22] https://www.talquinelectric.com/services/rate-schedule-s-wastewater/.
[23] The bid costs for a pressure system, excluding the pumps station and over 4,250 feet of force main installation, average $26,210 per unit, a 14% reduction relative to the 44-unit system in Section 2.3.6.
[24] Tallahassee Land Development Code Sec. 21-151. – Water systems charge fund and sewer systems charge fund established; functions; charges levied.
[25] DEP and NWFWMD awarded $637,000 to connect about 130 properties currently on septic systems to the existing centralized wastewater collection system in the PFA inside the corporate limits of the City of Tallahassee. [https://www.talgov.com/you/seweroverseptic-grantdetails.aspx]
[26] https://www.talquinelectric.com/services/rate-schedule-s-wastewater/.

2.4.4 Performance-Based Treatment Systems

There are no user system charges for PBTSs.

2.4.5 Cluster Systems

For purposes of this study, there are no explicit user charges for cluster systems, passive or active. User charges are the vehicle by which annual operation and maintenance (O&M), monitoring and inspection, life-cycle replacement costs, and administrative overhead (if any) are captured from participants. These discrete charges are included in the respective sub-sections in this report. All routine expenses for system operation and upkeep could be consolidated into a comprehensive, single-user cost, assessed at regular intervals (e.g., monthly or annually), however, these will vary based on system size, site conditions, and choice of management model.[27] As costs for O&M, replacement, etc., as defined here would be incorporated into rates to support the selected management structure, the primary uncaptured cost would be administrative (e.g., billing, reporting, legal). Management structures will be recommended in a subsequent phase of this study, consistent with the needs of target areas, and costs will reflect the scale of operations expected.

2.4.6 Gravity and Pressure Centralized Wastewater Collection Systems

Regardless of the collection system, outside the city limits, the City of Tallahassee's current monthly rates include $30.14 customer charges plus $0.944 per 100 gallons. Using the 300 gallons per household per day benchmark, the variable, gallon-based cost is $84.96 per month, and the total costs are $115.10 per month or $1,381 per year. These costs exclude charges for potable water service, which is the basis for the facility charges. Further, service connection fees of $50 apply to new (or transferred) residential utility accounts.

Talquin Electric Cooperative provides a tiered rate structure. The facilities charge is $38.75, with rates of $2.85/1,000 gallons for the first 5,000 gallons, and $3.90/1,000 gallons above 5,000 gallons. The facility's cost is based on meter size and is greater for water meters connected to water supply pipes with diameters that are greater than three-quarters inch. At 300 gallons per household per day, the variable, gallon-based cost is $15.60 per month, and the total cost is $54.35 per month or $652 per year. This cost excludes charges for potable water service, which is the basis for the facility charges.

A one-time system charge of $4,500 for both the City of Tallahassee and Talquin is included under Sections 2.3.6 and 2.3.7 rather than as part of monthly or cyclical user charges of Section 2.4.

2.5 Land Acquisition (including Rights-of-Way or Easements)

The use of land and easements may be necessary for the siting, establishment, and maintenance of the collection network in cluster or centralized wastewater collection systems. No ROW should be necessary for systems that are on the parcel served by the cluster or collection system.

2.5.1 Onsite Sewage Treatment and Disposal Systems

The land required for an OSTDS is assumed to be on the parcel served by the system; no additional land or easement is required.

2.5.2 In-Ground Nitrogen-Reducing Biofilters

The land required for an INRB is assumed to be on the parcel served by the system; no additional land or easement is required.

2.5.3 Aerobic Treatment Units

The land required for an ATU is assumed to be on the parcel served by the system; no additional land or easement is required.

[27] User charges would be determined by the Responsible Management Entity (RME) selected for the cluster system. Several models of RMEs are discussed in Appendix I.

2.5.4 Performance-Based Treatment Systems

The land required for a PBTS is assumed to be on the parcel served by the system; no additional land or easement is required.

2.5.5 Cluster Systems

The need for land or easements for cluster systems (regardless of treatment option) is variable, depending on the configuration and the numbers of houses to be served. A buffer is necessary around the drainfield to avoid a potential liability issue for surrounding properties using private wells for potable water. Seventy-five feet is the minimum distance from a drainfield to a private well (per 64E-6, F.A.C.). As an example, using a 75-foot buffer for a drainfield size of 20 feet by 50 feet (required for two units), the outer dimension of the buffer will be 170 feet by 200 feet or 34,000 square feet (about 0.78 acre). A regression equation of required land area versus the number of units is:

Land area in acres = 0.639 acre + (0.772 acre per unit × the number of units)

The adjusted coefficient of determination (R^2) for the regression is 0.99.

Land prices are variable in Leon County, especially between the southern and northern regions. Table 4 provides the current Property Appraiser market values for vacant parcels within the study area.

Table 4. *Leon County vacant land values*

Category	Number of Parcels	Average Price per Acre	Median Price per Acre
All Vacant	6,353	$27,519	$14,000
>1 Acre	4,232	$18,911	$10,000
>2 Acre	2,967	$13,422	$8,000
>5 Acre	1,708	$8,576	$6,000

The Property Appraiser's valuations typically fall 5% to 15% below final sales prices, in part reflecting price inflation for the time between assessment and when sales occur, brokers' fees, etc. For the purpose of estimating land costs for a range of sizes for cluster systems, a 2-acre threshold and the median (not average) price of $9,200 per acre was applied. Using this cost as a basis, Table 5 presents the minimum land cost for the treatment system, as a function of the number of dwellings served, with the required land area determined using the regression equation given above. These land costs do not include land transfer costs, such as survey costs and legal costs. While land costs are estimated to be $1,461 per unit for the exact areas needed to support an 8-unit system, for purposes of costs here, 2 acres are assumed to be required ($18,400 or $2,300 per unit).

Table 5. *Minimum land costs for cluster system drainfields*

Number of Houses	Average Flow	Required Drainfield	Length of Drainfield	Width of Drainfield	Required Lot Size (acre)	Land Costs	Land Cost per Unit
2	600	1000	20.0	50.0	0.78	$7,176	$3,588
3	900	1500	21.0	71.4	0.87	$8,004	$2,668
4	1200	2000	22.0	90.9	0.95	$8,740	$2,185
5	1500	2500	23.0	108.7	1.03	$9,476	$1,895
8	2400	4000	23.6	168.5	1.26	$11,684	$1,461
10	3000	5000	24.0	208.3	1.43	$13,156	$1,316
15	4500	7500	25.0	300.0	1.81	$16,652	$1,110
16	4800	8000	26.0	307.7	1.85	$17,020	$1,064

Depending upon the location and the collection network configuration, additional easements may be necessary to connect homes to the cluster system drainfield. Easements may be designated on existing public or private land, in which case, no additional costs accrue. However, crossing of private property may be expected to require an easement. In general, easements, as less-than-fee-simple ownership, do not cost as much as property without encumbrances. For purposes of access or utility placement, easements may be expected to cost between 10% and 30% of the affected property value. Within the study area, where the median land value is $9,200 per acre and with a factor of 20%, easements—where necessary—will cost about $1,840 per acre. At a minimum width of 10 feet (to provide for maintenance), easement costs will be about $0.42 per linear foot of easement.[28]

2.5.6 Gravity and Pressure Centralized Wastewater Collection Systems

For purposes of this review, land required to establish a connection to a centralized wastewater collection system is assumed to be on the parcel, so that additional land is not required. However, depending on the topography and network configuration, sewer mains or trunks may need to be sited on existing parcels and not in an existing easement. In these cases, utility easements will be required. Costs were not evaluated for this circumstance. Ordinarily, if the property owner providing the easement is among those receiving the service, the easement is granted to the utility. To the extent that the connection system does not impact or impede all other uses of the property (e.g., installing a swimming pool or other subsurface feature), there is no effect on property value. For connections other than service laterals, the city typically requires an easement width of 30 feet, or no less than 20 feet if 30 feet is not available.

In the event that public roadways are used, utility easements within the ROW already exist. In private subdivisions permitted after the implementation of the Tallahassee-Leon County Comprehensive Plan, utility easements are typically included in the shared roadways. Where ROW/easements must be acquired on private lands, the cost can range greatly, depending on the need to use eminent domain (and if attorney fees are included). In most situations, additional easement and ROW acquisition is not required for the installation of a central sewer system.

2.6 Operating, Maintenance, Repair, and Replacement Expenses

For this evaluation, O&M expenses are generalized to include all non-construction costs. These include routine system inspections, upkeep, and repair of damaged or non-functioning items, lifecycle replacement for major components, energy (e.g., electricity), and administration (including licensing).

2.6.1 Onsite Sewage Treatment and Disposal Systems

Minor maintenance for OSTDSs includes the occasional need for sewage to be pumped from the OSTDS when the OSTDS fails and sewage does not flow to the drainfield. Major maintenance costs for OSTDS are limited to the need to replace the drainfield; tank failures are rare, although baffles can become clogged or ineffective. There are no license fees.

Per "Homeguide"[29] the national average cost to clean and pump a septic tank is between $295 and $610, with a median cost of $375. However, depending on the size of the tank, pumping costs can range from $250 for a 750-gallon tank to $895 for a 1,250-gallon tank (2020 data).[30] USEPA and various state guidelines suggest septic tanks should be pumped out once every 3 to 5 years. Using the median cost and a frequency of 4 years, tank maintenance has an expected cost of $94 per year. Baffle replacement is estimated to be $400, with a lifespan approaching 20 years. Including the baffle cost increases annual tank maintenance to about $114 per year.

Complete drainfield replacement can cost between $2,000 and $10,000 (HomeAdvisor reports a range of $7,200 to $20,000).[31] Replacement of the distribution pipes alone can cost up to $5,000. The national average for the drainfield replacement is about $7,500, with a lifespan of 15 to 20 years, although well-maintained systems can

[28] Note: If a cluster system were to rely on a package plant with discharge to surface water, an additional easement may be required if the facility is not located on property directly fronting the receiving water.
[29] https://homeguide.com/.
[30] Two local bids (2020) averaged $308 as part of a larger bid for multiple retrofits.
[31] Two local bids (2020) averaged $7/square foot (sf), or $2,100 for the basic installation of a 300-sf drainfield.

last longer than 30 years. At 17.5 years, the pro-rated costs are about $429 per year. Combined O&M for an OSTDS is $543 per year (exclusive of taxes).

2.6.2 In-Ground Nitrogen-Reducing Biofilters

In addition to routine septic tank pump-outs similar to an OSTDS, in a lifecycle study of passive nitrogen reducing systems, Stage 2 media for nitrogen reduction were assumed to require replacement approximately every 15 years.[32] Table 6 describes key maintenance costs for several different designs for Stage 1 and Stage 2 media.

Table 6. *Select operations costs for in-ground nitrogen-reducing biofilters.*

System ID	System Description	Media Replacement Cost	Annual O&M Costs	Annual Compliance
BHS-2	In-tank Stage 1 with R, dual-media Stage 2	$2,000	$461	$170
BHS-3	In-ground stacked Stage 1 over Stage 2a ligno with supplemental Stage 2b sulfur	$4,357	$499	$270
BHS-4	In-tank SP Stage 1, dual-media Stage 2	$3,199	$273	$270
BHS-5	In-tank Stage 1 with R, dual-media Stage 2	$3,671	$453	$270
BHS-6	In-tank stacked Stage 1 over Stage 2a ligno with supplemental Stage 2b sulfur	$1,667	$505	$170
BHS-7	In-ground stacked SP Stage 1 over Stage 2 ligno	$861	$242	$170
	AVERAGE	**$2,626**	**$406**	**$220**

Source: Florida Department of Health, Florida Onsite Sewage Nitrogen Reduction Strategies Study (2015)

Annual O&M costs in Table 6 are a composite and reflect tankage, media, piping, and “appurtenance” costs. Consequently, a typical system may be assumed to cost an average of $406 per year, plus another $220 in compliance costs, for a total of $626 per year. Compliance includes inspection, monitoring and reporting and is separate from initial permitting.

2.6.3 Aerobic Treatment Units

Operations costs for ATU systems include site visits for inspection (annual or semi-annual) and pump-outs as required by service guidance (and warranty), as well as replacement of parts with variable lifespans. These components, which vary by design, can include aerators, blowers, compressors, pumps, and control panels. There are no license fees.

Based on more than 35 installations of ATUs, maintenance costs average $324 per year, while the system lifecycle costs average $91 per year, for a total of $415 per year. Operating costs will include electricity. Based on average annual consumption of 809 kilowatt-hours (kWh) and the City of Tallahassee’s rate of $0.21636 per kWh, annual power costs are estimated at $175.[33] Total unit O&M costs are $590 per year.

For purposes of this benefit-cost analysis, the tank and drainfield O&M costs for an ATU system are assumed to be similar to that of a traditional OSTDS, i.e., pro-rated at about $543 per year, although actual costs are likely less as the drainfield lifespan may be lengthened by the partial treatment provided by the ATU. Total system O&M costs are $1,133 annually.

2.6.4 Performance-Based Treatment Systems

Operations costs for PBTSs include site visits for inspection (annual or semi-annual) and pump-outs as required by service guidance (and warranty), as well as replacement of parts with variable lifespans. These components, which vary by design, can include aerators, blowers, compressors, pumps, and control panels. There are no license fees.

Based on 30 installations, the breakdown of costs for PBTS is $273 per year for O&M, $94 per year for lifecycle costs, and $131 per year for electricity. Total unit O&M cost for a PBTS is estimated to be $497 per year.

[32] Hazen & Sawyer, 2015.
[33] The Lombardo Associates study (2011) assumed a rate of $0.11/kilowatt hour (kWH), $0.126 in 2020 dollars, significantly less than current rates.

For purposes of benefit-cost analysis, the tank and drainfield O&M cost for a PBTS is assumed to be similar to that of a traditional OSTDS, i.e., pro-rated at about $543 per year, although actual cost is likely less since the drainfield lifespan may be lengthened by the partial treatment provided by the PBTS. Total system O&M cost is $1,040 annually.[34]

2.6.5 Cluster Systems

Operation costs for active cluster systems will include site visits for inspection (annual or semi-annual) and pump-outs as required by service guidance (and warranty), as well as replacement of parts with variable lifespans. These components, which vary by design, can include aerators, blowers, compressors, pumps, and control panels. There are no license fees.

O&M of passive cluster systems, such as INRBs, include inspections of the collection network, maintenance of headworks and, most significantly, replacement of the nitrogen-reducing media (see Section 2.6.2). Consequently, with increasing numbers of units served, economies of scale would be realized for the fixed, non-variable O&M costs. However, costs for media replacement (less excavation and disposal) may be expected to be proportional to the number of units served. As with ATUs and PBTSs, replacement of individual tanks and the cluster drainfield itself would be required at appropriate intervals.

Table 7 provides O&M costs for one brand of active system (PBTS) that offers multiple sizes capable of handling from 2 to potentially 20 households (at 300 gpd/household). While the O&M costs for these systems increase with successive sizes, the costs per unit decrease from about $225 per year (for two units) to about $114 per year for a 20-unit system.[35] Including maintenance of the cluster drainfield and individual tanks increases the total annualized O&M cost per unit to $365 for 2 units and $234 for 20 units. The values for 8 units have been interpolated.

Table 7. *O&M costs for variably sized performance-based treatment systems*

Units	GPD	Base O&M	Base O&M/Unit	Drainfield	Total O&M	Total O&M/Unit
1	500	$450	$450	$200	$650	$650
2	700	$450	$225	$280	$730	$365
3	900	$700	$233	$360	$1,060	$353
4	1,000	$700	$175	$400	$1,100	$275
6	1,900	$900	$150	$760	$1,660	$277
8	2,433	$1,100	$139	$973	$2,073	$259
9	2,700	$1,200	$133	$1,080	$2,280	$253
20	6,000	$2,284	$114	$2,400	$4,684	$234

2.6.6 Gravity and Pressure Centralized Wastewater Collection Systems

All maintenance and system lifecycle and replacement costs are embedded in the user's monthly service charges (see Section 2.4.6). This is the case for both the City of Tallahassee and Talquin utilities. These costs assume that no grinder pumps (and separable related O&M costs) are required. The cost of any failure of the lateral between the home's wastewater drain(s) to the sewer main will be the responsibility of the individual homeowner.[36]

[34] In contrast, the Lombardo study (2011) estimated annual O&M costs for PBTS AWT systems to be between $486 and $596, and between $668 and $822 for Suspended Growth systems (Task 2, Table 3-3). Based on the Consumer Price Index, the change between 2011 and June 2020 is about 14.6%. At that rate, the "high" costs for O&M for the less costly designs would only be $683 per year, significantly less than the $1,040 estimated.
[35] O&M costs for the 6,000-gpd unit were estimated via regression.
[36] City of Tallahassee Gravity Sewer Service Lateral Policy (Effective January 1, 1991; Revised July 11, 2016).

3.0 Cost-Effectiveness Evaluation

Cost-effectiveness was measured through several lenses: (1) the cost per pound of nitrogen removed, (2) the cost per pound of nitrogen removed relative to performance by a traditional OSTDS, and (3) the benefit-cost ratio of the treatment alternatives, including the market and non-market benefits of reductions in total nitrogen discharged from the wastewater systems.

3.1 Assumptions

The JSA team made the following assumptions in the cost-effectiveness and benefit-cost evaluations:

- The period of economic analysis is 20 years.
- Where applicable, the inflation rate is 3% and the discount rate is 7%.
- The volume of wastewater generated is 300 gallons per household or connection per day.
- The typical concentration of total nitrogen in OSTDS effluent is 23.97 milligrams per liter (mg/L), based on 2.43 persons per household and 300 gallons per day discharge. The Task 1 report defined OSTDS loads at an average of 9.012 pounds of total nitrogen per person per year.[37]
- Nitrogen reduction for a centralized wastewater collection system was 95%.[38]
- As part of the cost evaluation, penalties for BMAP non-compliance were set at zero.[39] Penalties may occur where or when nitrogen reduction targets are not met with OSTDS upgrades to AWTS.
- INRB drainfield nitrogen reduction is based on the values presented by Hazen & Sawyer (2015). That study used a lined low-pressured dosed drainfield, which is not permitted under the current Florida Department of Health rule. If lined low-pressure dosed drainfield are permitted under rule or if amended nitrogen reduction values be determined, this study can be updated.

3.2 Approach

Appendix H presents the content and output of the benefit-cost analysis. The data described in Appendices A through G and in Section 2.0 were incorporated as expected annual or one-time costs, as applicable. Total costs over the 20-year economic horizon for this project were calculated using the indicated inflation and discount rates.[40]

The analysis includes both market items and non-market items. Market items (e.g., capital costs for treatment systems) reflect actual prices paid in the local economy. These may include, for example, documented installer prices for AWTS units or costs for electricity for system operations based on current prices per kilowatt-hour and specification sheet estimates on energy use. Non-market items, however, are not bought and sold directly, and pricing is not explicit. Consequently, professionally accepted non-market valuation methods must be employed. These typically include revealed preferences (e.g., hedonic pricing), stated preferences (e.g., contingent valuation, travel-cost methods, willingness-to-pay studies, etc.), and avoided costs, among other means. Non-market values are not hypothetical; they reflect the values that a community places on environmental outcomes and may require one or more methods to provide an objective estimate of that value. The analysis presented applied conservative measures to minimize overstating the scale of non-market costs and benefits and reduced

[37] University of Florida Institute of Food and Agricultural Sciences, Florida Department of Health report a total of 11.2 grams of total nitrogen per person per day, derived from USEPA documents.
[38] The value reflects that for the City of Tallahassee's T.P. Smith WWTP. Percent reduction in nitrogen load for Talquin systems is estimated at 65% and was not evaluated.
[39] Current DEP enforcement authority provides for "monetary penalties of up to $10,000 per day per violation." However, as a practical matter, the agency will pursue the use of a consent order to achieve compliance. This latter route still imposes administrative costs upon the County for legal and technical support (Personal communication, Kevin Coyne, DEP, April 8, 2020).
[40] In contrast, the Lombardo Associates study used an interest rate of 5% and system lifespans that were several times those indicated by current literature.

the set of measures to avoid double-counting. The intent was to incorporate at least some of the economic consequences of the environmental changes expected under the treatment alternatives considered. These relate to the impacts of reduced total nitrogen in surface and ground waters in Leon County and the Wakulla springshed. Appendix J includes nutrient removal data from 40 DEP-funded stormwater management projects to support the non-market benefits (as avoided costs) associated with nutrient reduction.

In the context of this study, direct costs for the options evaluated include land costs, capital or system costs, installation costs, connection fees, typical O&M costs, life-cycle/replacement costs, and utility rates where applicable. Indirect costs include those of compliance. Non-market costs include the costs of disease from well contamination[41] and diminished tourism, as measured by changes in water clarity at Wakulla Spring (measured here by the use of glass-bottom boats). Total costs—including out-of-pocket costs and costs imposed on resource users—are the responsibility of the property owner.

Benefits include utility revenues and connection fees, avoided treatment costs (for removing nutrients), and individual willingness to pay for water quality. In this study, the avoided costs were restricted to those for nitrogen to ensure no double-counting of benefits.[42] These benefits accrue at the community (county-wide) level. Communications with the Leon County Property Appraiser's Office indicate that no increase in just (fair) market value (or assessed/taxable value) uniquely accrues to properties with connections to centralized wastewater collection systems, as compared to OSTDSs or other AWTSs. Consequently, property value enhancement and ad valorem revenues (property taxes) are zero for all options.[43]

Total discounted costs and benefits are calculated for all options. These are subtracted from the OSTDS case costs, for comparison. Net benefits and the benefit-cost ratio relative to OSTDS are also calculated.

3.3 Costs per Pound of Nitrogen Reduced

Based on the life-cycle costs determined as part of the benefit-cost tables (Appendix H), cost-effectiveness was calculated as the total costs per unit over the 20-year planning horizon divided by the expected pounds of nitrogen reduced (avoided discharges to groundwater or surface waters). Table 8 describes the expected annual differences between the several wastewater treatment options considered.

Table 8. *Nitrogen load reduction by option, percent relative to OSTDS*

	Percent Nitrogen Reduction		
Treatment Option	**Base***	**Additional Treatment Relative to Base**	**Total Treatment**
OSTDS (Base Case)	50.0%	0.0%	50.0%
ATU		+80.0%	90.0%
PBTS		+95.0%	97.5%
INRB		+65.0%	82.5%
Central Sewer		+95.0%	97.5%

* Base treatment efficiency includes reductions from the tank, drainfield, and underlying soil consistent with Lyon and Katz (2018).

Cluster systems will ultimately rely on one of the advanced technologies (ATU, PBTS, or INRB), so the percentage reduction relative to OSTDS will be equivalent to that choice. No change in efficiency is assumed based on the scale of the system. Note that between the nitrogen reduction achieved in the tank and that

[41] Via benefit transfer from other Florida locations. The Leon County Health Department has no records for boil-water advisories, although the Tallahassee Democrat reported several, including July 2007, December 2014, July 2017, and October 2018.
[42] Appendix J includes costs per kg/yr removed for both nitrogen and phosphorus.
[43] Personal communication, Curt Chisholm, Residential Analyst, Leon County Property Appraiser's Office, January 14, 2020.

obtained by a traditional drainfield, a well-maintained PBTS can achieve reductions equal to that of a centralized wastewater collection system.

Table 9 translates the percent nitrogen reduction by each alternative into pounds of total nitrogen reduced, relative to the use of OSTDS. At 9.012 pounds per person per year and 2.43 persons per household,[44] the generation of nitrogen is 21.90 pounds per household per year (9.93 kilograms per household per year).

Table 9. *Nitrogen load reduction by option, in pounds nitrogen per household per year (lb-N/household/yr) and kilograms nitrogen per household per year (kg-N/household/yr).*

Treatment Option	Percent Reduction	Reduction lb-N/Household/yr	Reduction kg-N/Household/yr
OSTDS	50.0%	10.95	4.97
ATU	90.0%	19.71	8.94
PBTS	97.5%	21.35	9.68
INRB	82.5%	18.07	8.19
Central Sewer	97.5%	21.35	9.68

Table 10 estimates the total nitrogen reduced per unit, by option, over the 20-year economic planning horizon and calculates the cost per pound reduction based on the total direct costs, such as O&M and system replacement, from Appendix H.

Table 10. *Cost per pound of nitrogen reduced, by option*

Treatment Option	Reduction lb-N/unit/yr	Total 20-Year Reduction lb-N	Expected Life-Cycle Cost per Unit	Direct Costs Dollars per lb-N
OSTDS	10.95	219.00	$12,108	$56
ATU	19.71	394.20	$34,205	$87
PBTS	21.35	427.05	$39,249	$92
INRB	18.07	361.35	$14,506	$40
Cluster (ATU)*	(as above)	394.20	N/A	N/A
Cluster (PBTS)*	(as above)	427.05	$19,940	$47
Cluster (INRB)*	(as above)	361.35	$21,454	$59
Central Sewer (Gravity, Proximate)	21.35	427.05	$57,987	$136
Central Sewer (Pressure, Remote)	21.35	427.05	$59,067	$138

* The expected costs for cluster systems assume service for 8 units, as a midpoint in system size. For purposes of this analysis, costs for a cluster ATU are assumed to be similar to costs for a cluster PBTS.

At the household/connection level, inclusion of indirect costs (risk of waterborne disease from contaminated potable wells and diminished springs water clarity) has a minor impact on the costs per pound of nitrogen removed (Appendix H). Because of the significant capital investment for centralized wastewater collection systems, each of the OSTDS alternatives offers a more cost-effective approach to nitrogen reduction (as dollars per pound of nitrogen). It is emphasized, however, that each OSTDS alternative assumes a commitment to appropriate system O&M over the 20-year planning horizon.[45] Failure to adequately maintain or operate the systems as intended could increase the costs per pound of nitrogen removed, as the divisor (nitrogen) diminishes

[44] https://www.census.gov/quickfacts/leoncountyflorida.
[45] The Florida Department of Health (Roeder, 2013) documented frequencies of failure to operate ATUs and PBTSs, in part because of electricity costs, maintenance contracts, and intermittent occupation—such as at vacation homes. About one-third of randomly sampled systems were not operating.

while overall costs remain constant. Risk of failure, where treatment levels fall to that of an OSTDS for part of the planning horizon, was not factored into the benefit-cost analysis.

Centralized wastewater collection systems are expensive at the individual connection level if the cost of system extension is borne entirely by the homeowner, as calculated here. However, barring system outages, assurances of success in nitrogen reduction under centralized wastewater collection system options will remain constant over the planning horizon. The risk of being out of compliance is less, and repairs and restorative measures may be assumed to be prompt and already built into system charges, such that no additional costs accrue to the rate payer. Further, the costs for any future treatment system refinements to further reduce the nitrogen content of effluent or final discharge to groundwater will be carried by all system ratepayers, not just those in any newly served area.

Table 11 summarizes the costs and benefits of the several options at a 7% discount rate. No indirect costs were assigned; non-market benefits accrued to the options other than OSTDS. While all systems yielded more benefits than costs, primarily via avoided costs for removal of nitrogen, individual INRB systems and active (PBTS) cluster systems achieved the greatest benefit-cost ratios. The relative ranking of benefit-cost ratios was unaffected by other discount rates considered (4% and 10%), which will reflect the impact of timing of costs and benefits over the 20-year horizon. INRB and active (PBTS) clusters exhibited a greater benefit-cost ratio than the OSTDS.

Table 11. *Summary of costs and benefits, by option*

Option	Direct Costs	Non-Market Costs	Total Costs	Direct Benefits	Non-Market Benefits	Total Benefits	Benefit-Cost Ratio	Ratio Relative to Base
OSTDS	$12,108	$112	$12,320	$30,455	$0	$30,435	2.47	N/A
INRB	$14,506	$20	$14,526	$50,218	$1,006	$51,225	3.53	9.37
ATU	$34,205	$15	$34,220	$54,783	$1,006	$55,790	1.63	1.16
PBTS	$39,249	$9	$39,258	$59,349	$1,006	$60,355	1.54	1.30
Cluster (Passive)*	$21,454	$20	$21,474	$55,188	$1,006	$56,194	2.62	2.88
Cluster (Active)*	$19,940	$9	$19,950	$64,093	$1,006	$65,099	3.26	4.47
Central Sewer (Gravity)	$57,987	$2	$57,989	$93,338	$1,006	$94,344	1.63	1.40
Central Sewer (Pressure)	$59,067	$2	$59,069	$92,866	$1,006	$93,872	1.59	1.35

* The expected costs for cluster systems assume service for 8 units, as a midpoint in system size.

4.0 Preliminary Findings

The JSA team determined the following:

Finding 1. Costs for OSTDSs are significant when calculated as a separate component of new construction and the expected, annualized costs of drainfield replacement are included.

Finding 2. INRBs have the least cost per pound of nitrogen removed because these biofilters do not require hardware, electricity for equipment operation, annual maintenance, or annual monitoring.

Finding 3. Active systems are more cost-effective per pound of nitrogen removed than OSTDSs. Active systems include ATUs and PBTSs.

Finding 4. Different types of active cluster systems have similar benefit-cost ratios due to economies of scale and relatively greater total nitrogen removal rates. A PBTS is one example of an active cluster system.

Finding 5. Connection to a centralized wastewater collection system is the most expensive option if all costs are paid by the developer or property owner. At the same time, central sewer reduces nitrogen loads to groundwater more than other alternatives. If the central sewer construction is funded by a municipal utility, central sewer is more attractive than other alternatives.

Finding 6. Clustered systems, whether active or passive, appear more cost-effective than individual systems, where costs for land for the treatment system and drainfield are part of the business model. Land dedicated for this purpose during the design of a subdivision, while still part of development costs, can offset or eliminate the individual share of this expense. Cluster systems can offer efficiencies of scale for capital and operating costs.[46]

Finding 7. The benefit-cost ratio of central sewer improves marginally (0.08) if the connection fee is subsidized fully by a grant.

This Task 2 report reflects all comments received to date from Leon County. The JSA team may refine these findings as the plan develops further and when the final report is published.

[46] Appendix I summarizes the many considerations of managing a cluster system through a Responsible Management Entity.

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6.0 Appendices

Appendix A NSF standard 245 (nitrogen-reducing) certified aerobic treatment units in Florida (Rule 64E-6.012, F.A.C.)

Manufacturer	Equipment Series	NSF Tested Model	Third Party Certifying Organization	Florida-Approved NSF 245-Certified Models	Average Total Nitrogen Reduction NSF 245 Completion Report*	NSF 245 Report Date
Aquaklear, Inc.	AquaKlear	AK6S245	Gulf Coast Testing	AK6S245C, AK10S245C	51%	October 2010
Bio-Microbics, Inc.	BioBarrier	MBR 0.5	NSF International	MBR 0.5-N; MBR 1.0-N; MBR 1.5-N	79%	October 2011
Bio-Microbics, Inc.	MicroFAST	0.5	NSF International	MicroFast 0.5, 0.625, 0.75, 0.9, 1.51	55%	October 2008
Clearstream Wastewater Systems, Inc.	Clearstream	500 D	Gulf Coast Testing	500D, 500DST, 600D, 600DT, 600DC3, 750D, 750DT, 800D, 800DT, 1000D, 1000DT, 1500D	53%	March 2013
Delta Treatment Systems, LLC.	ECOPOD-N	E50-N	NSF International	E50-N, E-60-N, E75-N, and E100-N	53%	February 2010
Fuji Clean USA	CEN	5	NSF International	CEN 5, 7, 10, 14	74%	April 2015
Jet	Jet-CF	500	Gulf Coast Testing	J-500CF, J-750CF, J-1000CF, J-1250CF, J-1500CF	67%	December 2008 (revised December 2018)
Norweco, Inc.	Singulair TNT	TNT-500	NSF International	TNT-500**, 750**, 1000, 1250, 1500	68%	November 2007
Orenco Systems	Advantex	AX20RTN	NSF International	AX20RTN, AX20N	55%	May 2015

Notes:

[1]NSF approval for models of certain serial numbers only; see http://info.nsf.org/Certified/Wastewater/Listings.asp?Standard=040& for details.

Please note that Florida requires approval of treatment receptacles prior to sale and installations. A list of approved treatment receptacles for use with ATUs can be found at: http://www.floridahealth.gov/environmental-health/onsite-sewage/products/_documents/atu.pdf. Be aware that the model identification in that list is not always complete.

* DEP BMAP nitrogen-reducing requirements differentiate between systems that have 24 inches of separation between the bottom of the drainfield and the wettest season water table (WSWT) and those that do not. Existing systems (modifications/repairs) installed with less than 24 inches of water table separation between the bottom of the drainfield and the WSWT (as allowed per Rule 64E-6) must use systems that are capable of at least 65% nitrogen removal. New systems and modifications/repairs installed with at least 24 inches between the bottom of the drainfield and the WSWT may use any system capable of at least 50% nitrogen removal to comply with future BMAP requirements.

**Note that the TNT-500 is NSF 245 certified for a rated capacity of 500 gpd or 600 gpd; the TNT-750 is NSF 245 certified for a rated capacity of 750 gpd or 800 gpd.

Disclaimer: This list does not represent or imply an endorsement of any company, person, product, configuration, or technology. The list reflects the compiler's information as January 30, 2020.

Appendix B Capital costs at Big Pine Key (1998 dollars)

System Description	Estimated Capital Costs w/ SDI Effluent Disposal	O&M Costs	Minutes of Maintenance per year
Septic Tank with Subsurface Drip Irrigation (SDI) Bed	$7,872	$1,044	125
Bio-Microbics FAST with SDI Bed	$11,412	$1,507	235
Continuous Feed Cyclic Reactor AES-BESTEP with SDI Bed	$11,412	$1,284	260
Rotating Biological Contactor (RBC) with SDI Bed	$11,412	$1,246	215
Recirculating Sand Filter (RSF) with SDI Bed	$17,414	$1,333	235

Source: Ayres Associates (1998)

Notes: Capital costs include all equipment and installation and 20% contingency.
SDI system was AZTEX Products, Inc. Model 100.
O&M includes labor, energy at $0.10 per kilowatt-hour, permits, maintenance, repair, replacement (including SDI media), residuals disposal, and contingency

Appendix C Average performance data** for components of total nitrogen (TN) reducing performance-based treatment systems, where total nitrogen is expressed in milligrams per liter (mg/L).

Equipment Series	Equipment Tested	Type of Test	TN In (mg/L)	TN Out (mg/L)	TN Removal	Vendor	Innovative Status*
Advantex	Advantex 20x Mode 1	(%) N-testing concurrently with NSF-40, Squamish, B.C.	33	12	64%	Orenco Systems	Yes
	Advantex 20x Mode 3	N-testing after NSF-40, Squamish, B.C.	35	12	66%		Yes
Aerocell	Aerocell ATS SCAT-8-AC-C500	NSF+Nitrogen, Waco	40	9.3	77%	Quanics (Anua)	Yes
Aqua Safe	Aqua Safe 500	~31 N-tests during NSF-40 test	30.8	14.9	52%	Ecological Tanks, Inc.	Yes
Clearstream Model D	Clearstream 500 D	NSF 245 Prairieville, LA (June-November 2012)	42	19	53%	Clearstream Wastewater Systems, Inc.	Yes
		Prairieville, LA after NSF 245 (December 2013 – May 2014)	42.3	10.7	74.8%		
CE	Fuji Clean CE 5	NSF-40+Nitrogen, Waco	47.6	15.7	67%	Fuji Clean USA, LLC	Yes
CEN	Fuji Clean CEN 5	NSF 245, Waco TX (June – December 2014)	40	10.4	74%		Yes
Enviro-Guard	Enviro-Guard 0.75	NSF+Nitrogen with reduced sampling	46	20	57%	Consolidated Treatment Systems	n/a
MicroFAST	MicroFAST 0.5	Keys Study, Phase I (12 samples)	38.5	11.0	71%	Bio-Microbics	n/a
		Keys Study, Phase II (13- 14 samples)	48.0	11.5	76%		
		NSF 245 testing, Waco TX (September 2006 – April 2007)	38	17	55%		
	FAST	NSF40+Nitrogen	34.5	9.4	73%		
HOOT	HOOT H-500 AND	N-testing (25 samples) concurrent with NSF-40	26.3	9.63	63%	Hoot Aerobic Systems	n/a
Hydro-Kinetic	Hydro-Kinetic 600 FEU	NSF245, Norwalk OH (June 2011-December 2011)	36	8.7	76%	Norweco, Inc.	Yes
Nitrex	Nitrex (after LAI- specified pretreatment)	NSF-load, MASSTC 10/2001-03/2004	19.3	5.4	Additional 72%	Lombardo Associates, Inc.	Yes
		NSF-load, MASSTC 12/2004-10/2005	22.6	7.1	Additional 69%		
Singulair	Singulair 960 w/ Biokinetics phase 1 w/ recirc	16 N-tests at NSF-testing facility (Chelsea, MI)	25	6.8	73%	Norweco, Inc.	n/a
	Singulair 960 w/ Biokinetics phase 2 no recirc	8 N-tests at NSF-testing facility (Chelsea, MI)	25	11.8	53%		n/a
Septitech	Septitech Model 400	Environmental Technology Verification (MA)	39	14	64%	Septitech (Bio-Microbics)	Yes

*Yes = components are currently in innovative status (approval has occurred in a limited fashion, providing for a limited number of permits and additional testing); note construction permits for systems in innovative status must be reviewed by the Onsite Sewage Program office for compliance with the innovative system permit.
n/a indicates that the use of previously approved ATUs in nutrient-reducing systems is accepted based on third-party data.

**Average Testing Performance Data for Components of PBTS (see http://www.floridahealth.gov/environmental-health/onsite-sewage/products/_documents/pbts-components.pdf for average performance testing data for components of all PBTSs in Florida; this table is a subset of Table 2 of that document).

Construction permits for PBTSs must comply with Part IV of Rule 64E-6, Florida Administrative Code (for details, see memo HSES-10-001). For all PBTSs, the engineer will establish performance levels, and design the system to meet them. Approval of treatment receptacles is a separate matter and should be checked under the septic tank design approval listings http://www.floridahealth.gov/environmental-health/onsite-sewage/products/_documents/septic-tanks.pdf.

The table above summarizes test center testing results either associated with an NSF or USEPA Environmental Technology Verification (ETV) protocol or during the Big Pine Key study in Florida. These data have been used to evaluate treatment components that might be used as part of a nitrogen-reducing performance-based treatment system designed by engineers. These are systems that are designed to reduce nitrogen to specified levels. The components listed in the table have previously been reviewed by the Bureau (Onsite Sewage Programs) as indicated in the column “innovative status.”

DEP BMAP nitrogen-reducing requirements differentiate between systems that have 24 inches of separation between the bottom of the drainfield and the WSWT and those that do not. Existing systems (modifications/repairs) installed with less than 24 inches of water table separation between the bottom of the drainfield and the WSWT (as allowed per Rule 64E-6) must use systems that are capable of at least 65% nitrogen removal. New systems and modifications/repairs installed with at least 24 inches between the bottom of the drainfield and the WSWT may use any system capable of at least 50% nitrogen removal to comply with future BMAP requirements. To assess the engineer-specified performance level, refer to the total nitrogen removal (%) column.

Appendix D Aerobic treatment unit characteristics.

Manufacturer	Model	Size	Capital Cost	Total Nitrogen Reduction	Annual O&M Cost	Annual Electrical Consumption (kWh)	Lifecycle costs/year	Year Installed	Notes	Comments
Singulair	TT		$11,337	55%	$300 (2 visits)	979.66		2019	Capital cost = Installation and 2-year operation and maintenance permit using new tank. Estimated $ across Maryland	
AquaKlear	AK6S245		$12,016	54%	$250 (1 visit)	298.70		2019	Capital cost = Installation and 2-year operation and maintenance permit using new tank. Estimated $ across Maryland	
Fuji Clean	CEN 5		$13,516	77%	$185 (2 visits)	446.70		2019	Capital cost = Installation and 2-year operation and maintenance permit using new tank. Estimated $ across Maryland	
Fuji Clean	CEN 7		$15,010	77%	$185 (2 visits)	648.20		2019	Capital cost = Installation and 2-year operation and maintenance permit using new tank. Estimated $ across Maryland	
Singulair	TNT		$8,000	68%	Semi-annual, pump-outs as needed	1160.70	Aerator every 7-10 years $500	2016	Capital cost = system (+2-year service) and delivery only, no other material or install. No separate septic tank needed	
Bio-Microbics	MicroFAST		$3,331 - $7,449	70+%	Annually, pump-outs as needed	1825.00	Blower every 7-10 years at $500	2016	Capital cost = suggested retail price, no installation. Energy use is maximum estimated.	Works as simple septic system without power
Delta	EcoPod-N		$10,000 - $12,000	50%	Semi-annual, pump-outs as needed every 3-5 years	1401.60	Air compressor every 5-7 years at $400	2016	Capital cost = installed, unit = $3,800.	Pretreatment required; system does not replace discharge components. Works as simple septic system without power
Fuji Clean	CEN unsure		$10,000 - $12,000	74%	Semi-annual; pump-outs as needed (every 2-3 years)	456.00	Blower every 5-6 years at $200	2016	Capital cost may not include install, does not include dispersal system.	Separate septic tank not needed. Functions as simple septic tank without power.
Jet	J-1500CF		$7,500	73%	Semi-annual; pump-outs as needed (every 2-3 years)	1810.29	Blower every 6-8 years at $700	2016	Capital cost = estimate, does not include installation or dispersal system. J-500CF and J-750 incorporate primary treatment. J-1000 through J-1500CF require separate septic tank	J500-J750 models can function as septic tank during power outage.

Manufacturer	Model	Size	Capital Cost	Total Nitrogen Reduction	Annual O&M Cost	Annual Electrical Consumption (kWh)	Lifecycle costs/year	Year Installed	Notes	Comments
Bio-Microbics	BioBarrier MBR		$7,140 - $16,650	96%	Semi-annual cleaning; pump-out as needed	1825.00	Membrane every 7 years at $1,295; pumps every 2-5 years at $200; blower every 7-10 years at $500	2016	Capital cost = recommended retail price, does not include installation. Energy use is maximum estimate. Total nitrogen reduction reported by manufacturer	Does not replace discharge components.
Singulair	TNT	(4br home)	$13,450		$315 (1-year contract)	979.66	Aerator every 10 years at $500, control panel replacement every 20 years at $1,200 (rare)	2018	Capital cost includes installation of system using existing leaching structure/field	Avg costs for 17 projects (models unknown, varying site constraints, varying leaching field types): Installation: $15,932.41; leaching: $3,898.62; engineering: $2,500; TOTAL: $22,331.03
Singulair	TNT	(4br home)	$16,097		$315 (1-year contract)	979.66	Aerator every 10 years at $500, control panel replacement every 20 years at $1,200 (rare)	2018	Capital cost includes installation of system using existing leaching structure/field	Avg costs for 17 projects (models unknown, varying site constraints, varying leaching field types): Installation: $15,932.41; leaching: $3,898.62; engineering: $2,500; TOTAL: $22,331.03
Singulair	TNT	(4br home)	$16,198		$315 (1-year contract)	979.66	Aerator every 10 years at $500, control panel replacement every 20 years at $1,200 (rare)	2018	Capital cost includes installation of system using existing leaching structure/field	Avg costs for 17 projects (models unknown, varying site constraints, varying leaching field types): Installation: $15,932.41; leaching: $3,898.62; engineering: $2,500; TOTAL: $22,331.03
Singulair	TNT	(4br home)	$18,149		$315 (1-year contract)	979.66	Aerator every 10 years at $500, control panel replacement every 20 years at $1,200 (rare)	2018	Capital cost includes installation of system using existing leaching structure/field	Avg costs for 17 projects (models unknown, varying site constraints, varying leaching field types): Installation: $15,932.41; leaching: $3,898.62; engineering: $2,500; TOTAL: $22,331.03
Singulair	TNT	(4br home)	$18,664		$315 (1-year contract)	979.66	Aerator every 10 years at $500, control panel replacement every 20 years at $1,200 (rare)	2018	Capital cost includes installation of system using existing leaching structure/field	Avg costs for 17 projects (models unknown, varying site constraints, varying leaching field types): Installation: $15,932.41; leaching: $3,898.62; engineering: $2,500; TOTAL: $22,331.03

Manufacturer	Model	Size	Capital Cost	Total Nitrogen Reduction	Annual O&M Cost	Annual Electrical Consumption (kWh)	Lifecycle costs/year	Year Installed	Notes	Comments
Fuji Clean	CEN unsure	(4br home)	$13,975		$300 (1-year contract)	463.55	Blower every 10 years at $320 or $420, blower rebuild every 10 years at $150, float replacement 5-10 years at $100, control panel replacement every 20 years at $400	2018	Capital cost includes installation of system using existing leaching structure/field	Avg costs for 17 projects (models unknown, varying site constraints, varying leaching field types): Installation: $15,932.41; leaching: $3,898.62; engineering: $2,500; TOTAL: $22,331.03
Fuji Clean	CEN unsure	(4br home)	$15,586		$300 (1-year contract)	463.55	Blower every 10 years at $320 or $420, blower rebuild every 10 years at $150, float replacement 5-10 years at $100, control panel replacement every 20 years at $400	2018	Capital cost includes installation of system using existing leaching structure/field	Avg costs for 17 projects (models unknown, varying site constraints, varying leaching field types): Installation: $15,932.41; leaching: $3,898.62; engineering: $2,500; TOTAL: $22,331.03
Fuji Clean	CEN unsure	(4br home)	$16,481		$300 (1-year contract)	463.55	Blower every 10 years at $320 or $420, blower rebuild every 10 years at $150, float replacement 5-10 years at $100, control panel replacement every 20 years at $400	2018	Capital cost includes installation of system using existing leaching structure/field	Avg costs for 17 projects (models unknown, varying site constraints, varying leaching field types): Installation: $15,932.41; leaching: $3,898.62; engineering: $2,500; TOTAL: $22,331.03
Fuji Clean	CEN unsure	(4br home)	$16,958		$300 (1-year contract)	463.55	Blower every 10 years at $320 or $420, blower rebuild every 10 years at $150, float replacement 5-10 years at $100, control panel replacement every 20 years at $400	2018	Capital cost includes installation of system using existing leaching structure/field	Avg costs for 17 projects (models unknown, varying site constraints, varying leaching field types): Installation: $15,932.41; leaching: $3,898.62; engineering: $2,500; TOTAL: $22,331.03
Fuji Clean	CEN unsure	(4br home)	$17,067		$300 (1-year contract)	463.55	Blower every 10 years at $320 or $420, blower rebuild every 10 years at $150, float replacement 5-10 years at $100, control panel replacement every 20 years at $400	2018	Capital cost includes installation of system using existing leaching structure/field	Avg costs for 17 projects (models unknown, varying site constraints, varying leaching field types): Installation: $15,932.41; leaching: $3,898.62; engineering: $2,500; TOTAL: $22,331.03

Manufacturer	Model	Size	Capital Cost	Total Nitrogen Reduction	Annual O&M Cost	Annual Electrical Consumption (kWh)	Lifecycle costs/year	Year Installed	Notes	Comments
Fuji Clean	CEN unsure	(4br home)	$17,309		$300 (1-year contract)	463.55	Blower every 10 years at $320 or $420, blower rebuild every 10 years at $150, float replacement 5-10 years at $100, control panel replacement every 20 years at $400	2018	Capital cost includes installation of system using existing leaching structure/field	Avg costs for 17 projects (models unknown, varying site constraints, varying leaching field types): Installation: $15,932.41; leaching: $3,898.62; engineering: $2,500; TOTAL: $22,331.03
Fuji Clean	CEN unsure	(4br home)	$18,409		$300 (1-year contract)	463.55	Blower every 10 years at $320 or $420, blower rebuild every 10 years at $150, float replacement 5-10 years at $100, control panel replacement every 20 years at $400	2018	Capital cost includes installation of system using existing leaching structure/field	Avg costs for 17 projects (models unknown, varying site constraints, varying leaching field types): Installation: $15,932.41; leaching: $3,898.62; engineering: $2,500; TOTAL: $22,331.03
Fuji Clean	CEN unsure	(4br home)	$19,430		$300 (1-year contract)	463.55	Blower every 10 years at $320 or $420, blower rebuild every 10 years at $150, float replacement 5-10 years at $100, control panel replacement every 20 years at $400	2018	Capital cost includes installation of system using existing leaching structure/field	Avg costs for 17 projects (models unknown, varying site constraints, varying leaching field types): Installation: $15,932.41; leaching: $3,898.62; engineering: $2,500; TOTAL: $22,331.03
Singulair	TNT	(4br home)	$13,585			979.66		2017	Capital cost includes installation of system using existing leaching structure/field	Base engineering costs mostly $2,500 for up to 6br, max $5,200
Singulair	TNT	(4br home)	$16,241			979.66		2017	Capital cost includes installation of system with new gravity leaching structure/field	Base engineering costs mostly $2,500 for up to 6br, max $5,200
Fuji Clean	CEN unsure	(4br home)	$13,750			463.55		2017	Capital cost includes installation of system using existing leaching structure/field	Base engineering costs mostly $2,500 for up to 6br, max $5,200
Fuji Clean	CEN unsure	(4br home)	$14,180			463.55		2017	Capital cost includes installation of system using existing leaching structure/field	Base engineering costs mostly $2,500 for up to 6br, max $5,200
Fuji Clean	CEN unsure	(4br home)	$16,730			463.55		2017	Capital cost includes installation of system using existing leaching structure/field	Base engineering costs mostly $2,500 for up to 6br, max $5,200
Singulair	TNT		$13,000		$300	$144/year operating cost		2016	Capital cost includes installation of system using	

Manufacturer	Model	Size	Capital Cost	Total Nitrogen Reduction	Annual O&M Cost	Annual Electrical Consumption (kWh)	Lifecycle costs/year	Year Installed	Notes	Comments
									existing leaching structure/field	
Bio-Microbics	MicroFAST		$14,500		$250-$500			2016	Capital cost includes installation of system using existing leaching structure/field	
Bio-Microbics	BioBarrier MBR		$19,300		$500-$1,300			2016	Capital cost includes installation of system using existing leaching structure/field	
Bio-Microbics	MicroFAST 0.5	500 gpd	$7,787					2012	Capital cost is list price for complete unit from WEBTROL	
Bio-Microbics	MicroFAST 0.75	750 gpd	$9,823					2012	Capital cost is list price for complete unit from WEBTROL	

unsure = model number not specified by source

Data as assembled by FL. Dept. of Health

Appendix E Gravity centralized wastewater collection system costs (Annawood Subdivision).

Contractor	Price	Units	$/unit
Dowdy	$1,281,215	44	$29,119
Hale	$1,107,465	44	$25,170
M, Inc	$1,645,012	44	$37,387
		Average	**$30,558**

The above represents the total project amounts for bids received by Leon County for the indicated project. Individual line item amounts are available as part of public record.

Appendix F Pressure centralized wastewater collection system costs (Woodside Heights Retrofit).

Contractor	Price	Units	$/unit
Allen	$4,603,906	154	$29,895
M, Inc.	$4,309,000	154	$27,981
Sandco	$4,841,261	154	$31,437
		Average	**$29,771**

The above represents the total project amounts for bids received by Leon County for the indicated project. Individual line item amounts are available as part of public record. A bid received by one contractor for more than $7.5 million was taken to be an outlier among bids and not included in the above average.

Appendix G Cluster system costs.

1. Estimated costs for a 4-home cluster system collection system.*

Pay Item Description	Units	Unit Price	Quantity	Total Price
Mobilization	LS	$2,100.00	1	$2,100.00
Temporary Traffic Control	LS	$250.00	1	$250.00
Temporary Erosion, Sedimentation, and Water Pollution Control	LF	$6.00	250	$1,500.00
Solid Sod	SY	$3.69	110	$405.90
Sewer Manhole, 4-ft dia., 0 to 6.0-ft depth	EA	$3,948.25	1	$3,948.25
Sewer Manhole, 4-ft dia., 6.1- to 8.0-ft depth	EA	$4,563.88	1	$4,563.88
Gravity Sewer Main, 6-inch, 0 to 6.0-ft depth, PVC (DR26)	LF	$28.00	250	$7,000.00
Sewer Services, 8-inch x 4-inch, PVC (DR26), 60- to 200-ft length	EA	$5,637.50	4	$22,550.00
Septic Tank Abandonment	EA	$950.00	4	$3,800.00
			Total	**$46,118.03**

- Cost per unit without septic tank abandonment: $10,580
- Cost per unit with septic tank abandonment: $11,530

2. Estimated costs for an 8-home cluster system collection system.*

Pay Item Description	Units	Unit Price	Quantity	Total Price
Mobilization	LS	$3,400.00	1	$3,400.00
Temporary Traffic Control	LS	$340.00	1	$340.00
Temporary Erosion, Sedimentation, and Water Pollution Control	LF	$6.00	250	$1,500.00
Solid Sod	SY	$3.69	110	$405.90
Sewer Manhole, 4-ft dia., 0 to 6.0-ft depth	EA	$3,948.25	1	$3,948.25
Sewer Manhole, 4-ft dia., 6.1- to 8.0-ft depth	EA	$4,563.88	1	$4,563.88
Gravity Sewer Main, 6-inch, 0 to 6.0-ft depth, PVC (DR26)	LF	$28.00	250	$7,000.00
Sewer Services, 8-inch x 4-inch, PVC (DR26), 60- to 200-ft length	EA	$5,637.50	8	$45,100.00
Septic Tank Abandonment	EA	$950.00	8	$7,600.00
			Total	**$73,858.03**

- Cost per unit without septic tank abandonment: $8,283
- Cost per unit with septic tank abandonment: $9,232

* Costs reflect a cul-de-sac lot arrangement.

3. Estimated costs for a 16-home cluster system collection system.*

Pay Item Description	Units	Unit Price	Quantity	Total Price
Mobilization	LS	$6,000.00	1	$6,000.00
Temporary Traffic Control	LS	$600.00	1	$600.00
Temporary Erosion, Sedimentation, and Water Pollution Control	LF	$6.00	250	$1,500.00
Solid Sod	SY	$3.69	110	$405.90
Sewer Manhole, 4-ft dia., 0 to 6.0-ft depth	EA	$3,948.25	1	$3,948.25
Sewer Manhole, 4-ft dia., 6.1- to 8.0-ft depth	EA	$4,563.88	1	$4,563.88
Gravity Sewer Main, 6-inch, 0 to 6.0-ft depth, PVC (DR26)	LF	$28.00	250	$7,000.00
Sewer Services, 8-inch x 4-inch, PVC (DR26), 60- to 200-ft length	EA	$5,637.50	16	$90,200.00
Septic Tank Abandonment	EA	$950.00	16	$15,200.00
			Total	**$129,418.03**

- Cost per unit without septic tank abandonment: $7,139
- Cost per unit with septic tank abandonment: $8,089

4. Estimated costs for a 16-home cluster system collection system (linear).

Pay Item Description	Units	Unit Price	Quantity	Total Price
Mobilization	LS	$6,000.00	1	$6,000.00
Temporary Traffic Control	LS	$600.00	1	$600.00
Temporary Erosion, Sedimentation, and Water Pollution Control	LF	$6.00	250	$1,500.00
Solid Sod	SY	$3.69	378	$1,394.82
Sewer Manhole, 4-ft dia., 0 to 6.0-ft depth	EA	$3,948.25	3	$11,844.75
Sewer Manhole, 4-ft dia., 6.1- to 8.0-ft depth	EA	$4,563.88	1	$4,563.88
Gravity Sewer Main, 6-inch, 0 to 6.0-ft depth, PVC (DR26)	LF	$28.00	850	$23,800.00
Sewer Services, 8-inch x 4-inch, PVC (DR26), 60- to 200-ft length	EA	$5,637.50	16	$90,200.00
Septic Tank Abandonment	EA	$950.00	16	$15,200.00
			Total	**$155,103.45**

- Cost per unit without septic tank abandonment: $8,744
- Cost per unit with septic tank abandonment: $9,694

Appendix H Benefit-cost summaries.

Benefit:Cost Analysis Summary

Base Case: Conventional OSTDS

			20 Year Horizon				
			Cost				
Direct Costs	**Units**	**Quantity**	**One Time/ Annual Cost**	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**	**Comments**
Land Costs	$ / system	-	$0	$0	$0	$0	No Land Costs; Existing Ownership
Design & Permitting Costs	$ / system	1	$610	$610	$610	$610	County Health Dept.; Site Evaluation; Plumbing Permit
System Purchase (CAPEX)	$ / system	1	$6,055	$6,055	$6,055	$6,055	The typical costs of a 900-1000 gallon tank – suitable for a three-bedroom home are between $2,100 to $9,500, with a median cost of $6,055 including appropriately sized drainfield; Section 2.21
Installation / Connection	$ / system	1		$0	$0	$0	Included in System Purchase
O&M / Repair (OPEX)	$ / year	1	$114	$1,611	$1,292	$1,068	Combined O&M for OSTDS is $543/yr (exclusive of taxes).
System / Utility Rates*	$ / year	-	$0	$0	$0	$0	N/A
Replacement (Life-Cycle)	$ / year	1	$375	$5,300	$4,251	$3,512	National averages for drainfield/leachfield replacement and replacement of the distribution pipes are about $7,500, with a lifespan of 15-20 years (20 years applied)
		Direct Cost Sub-Total:		$13,576	$12,208	$11,244	
			Cost				
Indirect Costs	**Units**	**Quantity**	**One Time/ Annual Cost**	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**	**Comments**
Compliance Penalties (DEP)	$ / year	-	$0	$0	$0	$0	Per DEP, no fines are expected to be imposed; compliance via consent order
		Indirect Cost Sub-Total:		$0	$0	$0	
			Cost				
Non-Market Costs	**Units**	**Quantity**	**One Time/ Annual Cost**	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**	**Comments**
Shadow Price of Nutrient Pollution	$ / yr	-	$0	$0	$0	$0	
Water-borne Disease (potable well contamination)	occurrences/HH/yr	0.00167	$3,952	$93	$75	$62	Proportional to costs elsewhere in FL based on households at risk; costs include lost wages
Diminished Springs Tourism and other Recreation	$/HH/year	1	$3.26	$46	$37	$30	Loss of Wakulla Glass Bottom Boat usage based on 2020 OSTDS share of ~1990 Population
				$0	$0	$0	
		Non-Market Cost Sub-Total:		$139	$112	$92	
		Costs Total:		$13,716	$12,320	$11,337	
			Benefit				
Direct Benefits	**Units**	**Quantity**	**Unit Price**	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**	**Comments**
Grants; State/Federal Funds	$/system	-	$0	$0	$0	$0	
Property Value Enhancement	$/lot	-	$0	$0	$0	$0	N/A per Property Appraiser
Ad Valorem	$/year	-	$0	$0	$0	$0	N/A per Property Appraiser
Utility Revenues	$ / year	-	$0	$0	$0	$0	N/A
Avoided Treatment Costs - N	kg-N/HH/year	4.97	$541	$37,949	$30,435	$25,144	Per DEP Stormwater Project Costs per kg (Appendix J)
Avoided Treatment Costs - P	kg-P/HH/year	-	$0	$0	$0	$0	Per DEP Stormwater Project Costs per kg (Appendix J)
Residual Value	$ / system	-	$0	$0	$0	$0	None Assumed
				$0	$0	$0	
		Direct Benefits Sub-Total:		$37,949	$30,435	$25,144	
			Benefit				
Non-Market Benefits	**Units**	**Quantity**	**Unit Price**	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**	**Comments**
WTP for Surface Water Quality / Clarity	$/HH	-	$3	$0	$0	$0	EPA / Florida Study
WTP for Ground Water Quality	$/HH	-	$7	$0	$0	$0	EPA / Florida Study
Community values (aesthetics, recreation & springs tourism)	$/person	-	$32	$0	$0	$0	At 2.43 persons/HH
				$0	$0	$0	
		Non-Market Benefits Sub-Total:		$0	$0	$0	
		Benefits Total:		$37,949	$30,435	$25,144	

Results					
Net Benefits:		$24,233	$18,115	$13,807	
Benefit:Cost Ratio:		2.77	2.47	2.22	
Net present value per dollar of capital outlay					

Benefit:Cost Analysis Summary

Alternative 1a: In-Ground Nitrogen-Reducing Biofilter (Passive)

			20 Year Horizon							
			Cost							
Direct Costs	**Units**	**Quantity**	**One Time/ Annual Cost**	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
Land Costs	$ / system	-	$0	$0	$0	$0	$0	$0	$0	No Land Costs; Existing Ownership
Design & Permitting Costs	$ / system	1	$610	$610	$610	$610	$0	$0	$0	County Health Dept.; Site Evaluation; Plumbing Permit
System Purchase (CAPEX)	$ / system	1	$6,800	$6,800	$6,800	$6,800	$745	$745	$745	Average of current local bids; Section 2.2.2
Installation / Connection	$ / system	1		$0	$0	$0	$0	$0	$0	
O&M / Repair (OPEX)	$ / year	1	$626	$8,848	$7,096	$5,862	$7,237	$5,804	$4,795	Based on 30 installations, the breakdown of costs for PBTS is similar: $273/yr for O&M services; $94/yr for lifecycle costs; and $131/yr for electricity.
System / Utility Rates*	$ / year	-	$0	$0	$0	$0	$0	$0	$0	N/A
Replacement (Life-Cycle)	$ / year	1	$0	$0	$0	$0	-$5,300	-$4,251	-$3,512	Media replacement included in O&M
Direct Cost Sub-Total:				$16,258	$14,506	$13,272	$2,681	$2,298	$2,028	
			Cost							
Indirect Costs	**Units**	**Quantity**	**One Time/ Annual Cost**	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
Compliance Penalties (DEP)	$ / year	-	$0	$0	$0	$0	$0	$0	$0	Per DEP, no fines are expected to be imposed; compliance via consent order
Indirect Cost Sub-Total:				$0	$0	$0	$0	$0	$0	
			Cost							
Non-Market Costs	**Units**	**Quantity**	**One Time/ Annual Cost**	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
Shadow Price of Nutrient Pollution	$ / yr		$0.00	$0	$0	$0	$0	$0	$0	
Water-borne Disease (potable well contamination)	occurrences/HH/ yr	0.00017	$3,952	$9	$7	$6	-$84	-$67	-$56	10-fold increase in pathogen removal relative to Conventional
Diminished Springs Tourism and other Recreation	$/HH/year	1	$1.14	$16	$13	$11	-$30	-$24	-$20	INRB Residual as Percent of Conventional
Non-Market Cost Sub-Total:				$25	$20	$17	-$114	-$91	-$75	
Costs Total:				$16,283	$14,526	$13,289	$2,567	$2,207	$1,953	

			Benefit							
Direct Benefits	**Units**	**Quantity**	**One Time/ Annual Value**	**Total Benefit 4%**	**Total Benefit 7%**	**Total Benefit 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
Grants; State/Federal Funds	$/system			$0	$0	$0	$0	$0	$0	
Property Value Enhancement	$/lot	-		$0	$0	$0	$0	$0	$0	N/A per Property Appraiser
Ad Valorem	$/year	-		$0	$0	$0	$0	$0	$0	N/A per Property Appraiser
Utility Revenues	$ / year	-		$0	$0	$0	$0	$0	$0	
Avoided Treatment Costs - N	kg-N/HH/year	8.20	$541	$62,615	$50,218	$41,488	$24,667	$19,783	$16,344	Per DEP Stormwater Project Costs per kg (Appendix J)
Avoided Treatment Costs - P	kg-P/HH/year			$0	$0	$0	$0	$0	$0	Per DEP Stormwater Project Costs per kg (Appendix J)
Residual Value	$	-	$0	$0	$0	$0	$0	$0	$0	None Assumed
Direct Benefits Sub-Total:				$62,615	$50,218	$41,488	$24,667	$19,783	$16,344	
			Benefit							
Non-Market Benefits	**Units**	**Quantity**	**One Time/ Annual Value**	**Total Benefit 4%**	**Total Benefit 7%**	**Total Benefit 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
WTP for Surface Water Quality / Clarity	$/HH	1	$3.48	$49	$39	$33	$49	$39	$33	
WTP for Ground Water Quality	$/HH	1	$6.56	$93	$74	$61	$93	$74	$61	
Community values (aesthetics, recreation & springs tourism)	$/person	2.43	$32.41	$1,113	$893	$737	$1,113	$893	$737	
Non-Market Benefits Sub-Total:				$1,255	$1,006	$831	$1,255	$1,006	$831	
Benefits Total:				$63,870	$51,225	$42,319	$25,921	$20,789	$17,175	

Results							
Net Benefits:		$47,587	$36,698	$29,030	$23,354	$18,583	$15,223
Benefit:Cost Ratio:		3.92	3.53	3.18	10.10	9.42	8.80
Net present value per dollar of capital outlay							

Benefit:Cost Analysis Summary

Alternative 1b: Aerobic Treatment Unit

			20 Year Horizon							
Direct Costs	**Units**	**Quantity**	**Cost: One Time/ Annual Cost**	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
Land Costs	$ / system	-	$0	$0	$0	$0	$0	$0	$0	No Land Costs; Existing Ownership
Design & Permitting Costs	$ / system	1	$610	$610	$610	$610	$0	$0	$0	County Health Dept.; Site Evaluation; Plumbing Permit
System Purchase (CAPEX)	$ / system	1	$11,889	$11,889	$11,889	$11,889	$5,834	$5,834	$5,834	Section 2.2.3
Installation / Connection	$ / system	1	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	
O&M / Repair (OPEX)	$ / year	1	$1,133	$16,014	$12,843	$10,610	$14,402	$11,551	$9,543	Based on 30 installations, the breakdown of costs for PBTS is similar: $273/yr for O&M services; $94/yr for lifecycle costs; and $131/yr for electricity. Section 2.6.3
System / Utility Rates*	$ / year	-	$0	$0	$0	$0	$0	$0	$0	N/A
Replacement (Life-Cycle)	$ / year	1.00	$429	$6,063	$4,863	$4,018	$763	$612	$506	Similar to Base Case Drainfield
Direct Cost Sub-Total:				$38,576	$34,205	$31,127	$25,000	$21,997	$19,883	
Indirect Costs	**Units**	**Quantity**	**Cost: One Time/ Annual Cost**	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
Compliance Penalties (DEP)	$ / year	-		$0	$0	$0	$0	$0	$0	Per DEP, no fines are expected to be imposed; compliance via consent order
Indirect Cost Sub-Total:				$0	$0	$0	$0	$0	$0	
Non-Market Costs	**Units**	**Quantity**	**Cost: One Time/ Annual Cost**	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
Shadow Price of Nutrient Pollution	$ / yr			$0	$0	$0	$0	$0	$0	
Water-borne Disease (potable well contamination)	occurrences/HH/yr	0.00017	$3,952	$9	$7	$6	-$84	-$67	-$56	10-fold increase in pathogen removal relative to Conventional
Diminished Springs Tourism and other Recreation	$/HH/year	1	$0.65	$9	$7	$6	-$37	-$30	-$24	ATU Residual as Percent of Conventional
Non-Market Cost Sub-Total:				$19	$15	$12	-$121	-$97	-$80	
Costs Total:				$38,595	$34,220	$31,139	$24,879	$21,900	$19,802	
Direct Benefits	**Units**	**Quantity**	**Benefit: One Time/ Annual Value**	**Total Benefit 4%**	**Total Benefit 7%**	**Total Benefit 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
Grants; State/Federal Funds	$/system			$0	$0	$0	$0	$0	$0	
Property Value Enhancement	$/lot	-		$0	$0	$0	$0	$0	$0	N/A per Property Appraiser
Ad Valorem	$/year	-		$0	$0	$0	$0	$0	$0	N/A per Property Appraiser
Utility Revenues	$ / year	-		$0	$0	$0	$0	$0	$0	
Avoided Treatment Costs - N	kg-N/HH/year	8.94	$541	$68,307	$54,783	$45,259	$30,359	$24,348	$20,115	Per DEP Stormwater Project Costs per kg (Appendix J)
Avoided Treatment Costs - P	kg-P/HH/year			$0	$0	$0	$0	$0	$0	Per DEP Stormwater Project Costs per kg (Appendix J)
Residual Value	$ / system	-	$0	$0	$0	$0	$0	$0	$0	None Assumed
Direct Benefits Sub-Total:				$68,307	$54,783	$45,259	$30,359	$24,348	$20,115	
Non-Market Benefits	**Units**	**Quantity**	**Benefit: One Time/ Annual Value**	**Total Benefit 4%**	**Total Benefit 7%**	**Total Benefit 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
WTP for Surface Water Quality / Clarity	$/HH	1	$3	$49	$39	$33	$49	$39	$33	
WTP for Ground Water Quality	$/HH	1	$7	$93	$74	$61	$93	$74	$61	
Community values (aesthetics, recreation & springs tourism)	$/person	2.43	$32	$1,113	$893	$737	$1,113	$893	$737	
Non-Market Benefits Sub-Total:				$1,255	$1,006	$831	$1,255	$1,006	$831	
Benefits Total:				$69,562	$55,790	$46,091	$31,614	$25,355	$20,947	
Results										
Net Benefits:				$30,968	$21,570	$14,952	$6,735	$3,454	$1,144	
Benefit:Cost Ratio:				1.80	1.63	1.48	1.27	1.16	1.06	
Net present value per dollar of capital outlay										

Benefit:Cost Analysis Summary

Alternative 1c: Performance Based Treatment System

			20 Year Horizon							
			Cost							
Direct Costs	**Units**	**Quantity**	**One Time/ Annual Cost**	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
Land Costs	$ / system	-	$0	$0	$0	$0	$0	$0	$0	No Land Costs; Existing Ownership
Design & Permitting Costs	$ / system	1	$610	$610	$610	$610	$0	$0	$0	County Health Dept.; Site Evaluation; Plumbing Permit
System Purchase (CAPEX)	$ / system	1	$17,216	$17,216	$17,216	$17,216	$11,161	$11,161	$11,161	Section 2.2.4
Installation / Connection	$ / system	1	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	
O&M / Repair (OPEX)	$ / year	1	$1,040	$14,699	$11,789	$9,740	$13,088	$10,497	$8,672	Based on 30 installations, the breakdown of costs for PBTS is similar: $273/yr for O&M services; $94/yr for lifecycle costs; and $131/yr for electricity. Section 2.6.4
System / Utility Rates*	$ / year	-	$0	$0	$0	$0	$0	$0	$0	
Replacement (Life-Cycle)	$ / year	1	$497	$7,025	$5,634	$4,654	$1,724	$1,383	$1,143	Similar to Base Case Drainfield
Direct Cost Sub-Total:				$43,550	$39,249	$36,220	$29,973	$27,041	$24,975	
			Cost							
Indirect Costs	**Units**	**Quantity**	**One Time/ Annual Cost**	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
Compliance Penalties (DEP)	$ / year	-		$0	$0	$0	$0	$0	$0	Per DEP, no fines are expected to be imposed; compliance via consent order
Indirect Cost Sub-Total:				$0	$0	$0	$0	$0	$0	
			Cost							
Non-Market Costs	**Units**	**Quantity**	**One Time/ Annual Cost**	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
Shadow Price of Nutrient Pollution	$ / yr			$0	$0	$0	$0	$0	$0	
Water-borne Disease (potable well contamination)	occurrences/HH/ yr	0.00017	$3,952	$9	$7	$6	-$84	-$67	-$56	10-fold increase in pathogen removal relative to Conventional
Diminished Springs Tourism and other Recreation	$/HH/year	1	$0.16	$2	$2	$2	-$44	-$35	-$29	PBTS Residual as Percent of Conventional
Non-Market Cost Sub-Total:				$12	$9	$8	-$128	-$102	-$85	
Costs Total:				$43,562	$39,258	$36,228	$29,846	$26,938	$24,891	

			Benefit							
Direct Benefits	**Units**	**Quantity**	**One Time/ Annual Value**	**Total Benefit 4%**	**Total Benefit 7%**	**Total Benefit 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
Grants; State/Federal Funds	$/system			$0	$0	$0	$0	$0	$0	
Property Value Enhancement	$/lot	-		$0	$0	$0	$0	$0	$0	N/A per Property Appraiser
Ad Valorem	$/year	-		$0	$0	$0	$0	$0	$0	N/A per Property Appraiser
Utility Revenues	$ / year	-		$0	$0	$0	$0	$0	$0	
Avoided Treatment Costs - N	kg-N/HH/year	9.69	$541	$74,000	$59,349	$49,031	$36,051	$28,913	$23,887	Per DEP Stormwater Project Costs per kg (Appendix J)
Avoided Treatment Costs - P	kg-P/HH/year			$0	$0	$0	$0	$0	$0	Per DEP Stormwater Project Costs per kg (Appendix J)
Residual Value	$ / system	-	$0	$0	$0	$0	$0	$0	$0	None Assumed
Direct Benefits Sub-Total:				$74,000	$59,349	$49,031	$36,051	$28,913	$23,887	
			Benefit							
Non-Market Benefits	**Units**	**Quantity**	**One Time/ Annual Value**	**Total Benefit 4%**	**Total Benefit 7%**	**Total Benefit 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
WTP for Surface Water Quality / Clarity	$/HH	1	$3	$49	$39	$33	$49	$39	$33	
WTP for Ground Water Quality	$/HH	1	$7	$93	$74	$61	$93	$74	$61	
Community values (aesthetics, recreation & springs tourism)	$/person	2.43	$32	$1,113	$893	$737	$1,113	$893	$737	
Non-Market Benefits Sub-Total:				$1,255	$1,006	$831	$1,255	$1,006	$831	
Benefits Total:				$75,255	$60,355	$49,862	$37,306	$29,920	$24,718	

Results

Net Benefits:		$31,693	$21,097	$13,635	$7,460	$2,982	($172)
Benefit:Cost Ratio:		1.73	1.54	1.38	1.25	1.11	0.99
Net present value per dollar of capital outlay							

Benefit:Cost Analysis Summary

Alternative 2a: Cluster Treatment w/ INRB (Passive)

			20 Year Horizon							
			Cost							
Direct Costs	**Units**	**Quantity**	**One Time/ Annual Cost**	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
Land Costs	$ / system	1	$2,300	$2,300	$2,300	$2,300	$2,300	$2,300	$2,300	Section 2.5.5; Based upon $9200 per acre; 8 units assumed
Design & Permitting Costs	$ / system	1	$435	$435	$435	$435	-$175	-$175	-$175	Section 2.1.5; 8 Units Assumed; Design @ 10%
System Purchase (CAPEX)	$ / system	1	$2,875	$2,875	$2,875	$2,875	-$3,180	-$3,180	-$3,180	Section 2.3.4; 8 units assumed
Installation / Connection	$ / system	1	$8,283	$8,283	$8,283	$8,283	$8,283	$8,283	$8,283	Section 2.3.5.; Per Unit Costs, Gravity System
O&M / Repair (OPEX)	$ / year	1	$261	$3,689	$2,959	$2,444	$2,078	$1,666	$1,377	Section 2.6.5; 8 Units Assumed
System / Utility Rates*	$ / year	-	$0	$0	$0	$0	$0	$0	$0	8 Units Assumed
Replacement (Life-Cycle)	$ / year	1	$406	$5,738	$4,602	$3,802	$438	$351	$290	8 Units Assumed
							$0	$0	$0	
Direct Cost Sub-Total:				$23,320	$21,454	$20,139	$9,744	$9,246	$8,895	
			Cost							
Indirect Costs	**Units**	**Quantity**	**One Time/**	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
Compliance Penalties (DEP)	$ / year	-		$0	$0	$0	$0	$0	$0	Per DEP, no fines are expected to be imposed; compliance via consent order
Indirect Cost Sub-Total:				$0	$0	$0	$0	$0	$0	
			Cost							
Non-Market Costs	**Units**	**Quantity**	**One Time/ Annual Cost**	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
Shadow Price of Nutrient Pollution	$ / yr			$0	$0	$0	$0	$0	$0	
Water-borne Disease (potable well contamination)	occurrences/HH/yr	0.00017	$3,952	$9	$7	$6	-$84	-$67	-$56	10-fold increase in pathogen removal relative to Conventional
Diminished Springs Tourism and other Recreation	$/HH/year	1.00	$1.14	$16	$13	$11	-$30	-$24	-$20	
Non-Market Cost Sub-Total:				$25	$20	$17	-$114	-$91	-$75	
Costs Total:				$23,346	$21,474	$20,156	$9,630	$9,154	$8,819	

			Benefit							
Direct Benefits	**Units**	**Quantity**	**One Time/ Annual Value**	**Total Benefit 4%**	**Total Benefit 7%**	**Total Benefit 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
Grants; State/Federal Funds	$/system			$0	$0	$0	$0	$0	$0	
Property Value Enhancement	$/lot	-		$0	$0	$0	$0	$0	$0	N/A per Property Appraiser
Ad Valorem	$/year	-		$0	$0	$0	$0	$0	$0	N/A per Property Appraiser
Utility Revenues	$ / year	-		$0	$0	$0	$0	$0	$0	
Avoided Treatment Costs - N	kg-N/HH/year	8.20	$541	$62,615	$50,218	$41,488	$24,667	$19,783	$16,344	Per DEP Stormwater Project Costs per kg (Appendix J)
Avoided Treatment Costs - P	kg-P/HH/year			$0	$0	$0	$0	$0	$0	Per DEP Stormwater Project Costs per kg (Appendix J)
Residual Value	$/system	1	$4,970	$4,970	$4,970	$4,970	$4,970	$4,970	$4,970	30 yrs Residual Value
Direct Benefits Sub-Total:				$67,585	$55,188	$46,458	$29,636	$24,753	$21,313	
			Benefit							
Non-Market Benefits	**Units**	**Quantity**	**One Time/ Annual Value**	**Total Benefit 4%**	**Total Benefit 7%**	**Total Benefit 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
WTP for Surface Water Quality / Clarity	$/HH	1	$3	$49	$39	$33	$49	$39	$33	
WTP for Ground Water Quality	$/HH	1	$7	$93	$74	$61	$93	$74	$61	
Community values (aesthetics, recreation & springs tourism)	$/person	2.43	$32	$1,113	$893	$737	$1,113	$893	$737	
Non-Market Benefits Sub-Total:				$1,255	$1,006	$831	$1,255	$1,006	$831	
Benefits Total:				$68,840	$56,194	$47,289	$30,891	$25,759	$22,145	

Results								
Net Benefits:		$45,494	$34,720	$27,133	$21,261	$16,605	$13,326	
Benefit:Cost Ratio:		2.95	2.62	2.35	3.21	2.81	2.51	
Net present value per dollar of capital outlay								

Benefit:Cost Analysis Summary

Alternative 2b: Cluster w/ PBTS (Active)

			20 Year Horizon							
Direct Costs	**Units**	**Quantity**	**Cost**				**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
			One Time/ Annual Cost	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**				
Land Costs	$ / system	1	$2,300	$2,300	$2,300	$2,300	$2,300	$2,300	$2,300	Section 2.5.5; Based upon $9200 per acre; 8 units assumed
Design & Permitting Costs	$ / system	1	$1,163	$1,163	$1,163	$1,163	$553	$553	$553	Section 2.1.5; 8 Units Assumed; Design @ 10%
System Purchase (CAPEX)	$ / system	1	$4,938	$4,938	$4,938	$4,938	-$1,118	-$1,118	-$1,118	Section 2.2.5; System sized for ~10 units; allocated to 8 units
Installation / Connection	$ / system	1	$7,907	$7,907	$7,907	$7,907	$7,907	$7,907	$7,907	Per Unit Costs, Gravity System
O&M / Repair (OPEX)	$ / year	1	$133	$1,880	$1,508	$1,246	$269	$215	$178	8 Units Assumed
System / Utility Rates*	$ / year	-	$0	$0	$0	$0	$0	$0	$0	
Replacement (Life-Cycle)	$ / year	1	$188	$2,650	$2,125	$1,756	-$2,650	-$2,125	-$1,756	Drainfiled Replace; 8 Units Assumed
Direct Cost Sub-Total:				$20,837	$19,940	$19,309	$7,261	$7,732	$8,064	
Indirect Costs	**Units**	**Quantity**	**Cost**				**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
			One Time/	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**				
Compliance Penalties (DEP)	$ / year	-		$0	$0	$0	$0	$0	$0	Per DEP, no fines are expected to be imposed; compliance via consent order
Indirect Cost Sub-Total:				$0	$0	$0	$0	$0	$0	
Non-Market Costs	**Units**	**Quantity**	**Cost**				**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
			One Time/ Annual Cost	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**				
Shadow Price of Nutrient Pollution	$ / yr			$0	$0	$0	$0	$0	$0	
Water-borne Disease (potable well contamination)	occurrences/HH/yr	0.00017	$3,952	$9	$7	$6	-$84	-$67	-$56	10-fold increase in pathogen removal relative to Conventional
Diminished Springs Tourism and other Recreation	$/HH/year	1.00	$0.16	$2	$2	$2	-$44	-$35	-$29	
Non-Market Cost Sub-Total:				$12	$9	$8	-$128	-$102	-$85	
Costs Total:				$20,849	$19,950	$19,316	$7,133	$7,630	$7,980	
Direct Benefits	**Units**	**Quantity**	**Benefit**				**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
			One Time/ Annual Value	**Total Benefit 4%**	**Total Benefit 7%**	**Total Benefit 10%**				
Grants; State/Federal Funds	$/system			$0	$0	$0	$0	$0	$0	
Property Value Enhancement	$/lot	-		$0	$0	$0	$0	$0	$0	N/A per Property Appraiser
Ad Valorem	$/year	-		$0	$0	$0	$0	$0	$0	N/A per Property Appraiser
Utility Revenues	$ / year	-		$0	$0	$0	$0	$0	$0	
Avoided Treatment Costs - N	kg-N/HH/year	9.69	$541	$74,000	$59,349	$49,031	$36,051	$28,913	$23,887	Per DEP Stormwater Project Costs per kg (Appendix J)
Avoided Treatment Costs - P	kg-P/HH/year			$0	$0	$0	$0	$0	$0	Per DEP Stormwater Project Costs per kg (Appendix J)
Residual Value	$/system	1	$4,744	$4,744	$4,744	$4,744	$4,744	$4,744	$4,744	30 yrs Residual Value
Direct Benefits Sub-Total:				$78,744	$64,093	$53,775	$40,795	$33,658	$28,631	
Non-Market Benefits	**Units**	**Quantity**	**Benefit**				**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
			One Time/ Annual Value	**Total Benefit 4%**	**Total Benefit 7%**	**Total Benefit 10%**				
WTP for Surface Water Quality / Clarity	$/HH	1	$3	$49	$39	$33	$49	$39	$33	
WTP for Ground Water Quality	$/HH	1	$7	$93	$74	$61	$93	$74	$61	
Community values (aesthetics, recreation & springs tourism)	$/person	2.43	$32	$1,113	$893	$737	$1,113	$893	$737	
Non-Market Benefits Sub-Total:				$1,255	$1,006	$831	$1,255	$1,006	$831	
Benefits Total:				$79,999	$65,099	$54,607	$42,050	$34,664	$29,463	

Results

Net Benefits:		$59,150	$45,150	$35,290	$34,917	$27,034	$21,483
Benefit:Cost Ratio:		3.84	3.26	2.83	5.90	4.54	3.69
Net present value per dollar of capital outlay							

Benefit:Cost Analysis Summary

Alternative 3a: Central WWT w/out Lift Station

			20 Year Horizon							
			Cost							
Direct Costs	**Units**	**Quantity**	**One Time/ Annual Cost**	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
Land Costs	$ / system	-	$0	$0	$0	$0	$0	$0	$0	Use of existing ROW assumed
Design & Permitting Costs	$ / system	-	$100	$0	$0	$0	-$610	-$610	-$610	Plumbing Permit for lateral
System Purchase (CAPEX)	$ / system	1	$30,558	$30,558	$30,558	$30,558	$24,503	$24,503	$24,503	Gravity-only Collection System
Installation / Connection	$ / system	1	$11,775	$11,775	$11,775	$11,775	$11,775	$11,775	$11,775	Individual Laterals, plus outside city limit City System Charge ($4500) and Tap Location fee ($275); Section 2.3.6 and 2.3.7
O&M / Repair (OPEX)	$ / year	1	$0	$0	$0	$0	-$1,611	-$1,292	-$1,068	
System / Utility Rates*	$ / year	1	$1,381	$19,519	$15,654	$12,933	$19,519	$15,654	$12,933	Outside the city limits the City of Tallahassee's current monthly rates include $30.14 customer charges plus $0.944 per 100 gallons. Using the 300 gallons per household per day benchmark, the variable cost is $84.96 per month; total costs are $115.10 per month or $1,381 per year).
Replacement (Life-Cycle)	$ / year	-	$0	$0	$0	$0	-$5,300	-$4,251	-$3,512	Included in System Charges
		Direct Cost Sub-Total:		$61,852	$57,987	$55,266	$48,275	$45,779	$44,022	
			Cost							
Indirect Costs	**Units**	**Quantity**	**One Time/ Annual Cost**	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
Compliance Penalties (DEP)	$ / year	-		$0	$0	$0	$0	$0	$0	Per DEP, no fines are expected to be imposed; compliance via consent order
		Indirect Cost Sub-Total:		$0	$0	$0	$0	$0	$0	
			Cost							
Non-Market Costs	**Units**	**Quantity**	**One Time/ Annual Cost**	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
Shadow Price of Nutrient Pollution	$ / yr			$0	$0	$0	$0	$0	$0	
Water-borne Disease (potable well contamination)	occurrences/HH/ yr	-	$3,952	$0	$0	$0	-$93	-$75	-$62	
Diminished Springs Tourism and other Recreation	$/HH/year	1	$0.16	$2	$2	$2	-$44	-$35	-$29	Central Residual as Percent of Conventional
		Non-Market Cost Sub-Total:		$2	$2	$2	-$137	-$110	-$91	
		Costs Total:		$61,854	$57,989	$55,267	$48,138	$45,669	$43,931	
			Benefit							
Direct Benefits	**Units**	**Quantity**	**One Time/ Annual Value**	**Total Benefit 4%**	**Total Benefit 7%**	**Total Benefit 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
Grants; State/Federal Funds	$/system			$0	$0	$0	$0	$0	$0	
Property Value Enhancement	$/lot		$0	$0	$0	$0	$0	$0	$0	Per Leon County Property Appraiser, there is no evidence of increased value associated with central treatment
Ad Valorem	$/year		$0	$0	$0	$0	$0	$0	$0	No increment in ad valorem
Utility Revenues	$ / year	1	$1,381	$19,519	$15,654	$12,933	$19,519	$15,654	$12,933	City of Tallahassee
Avoided Treatment Costs - N	kg-N/HH/year	9.69	$541	$74,000	$59,349	$49,031	$36,051	$28,913	$23,887	Per DEP Stormwater Project Costs per kg (Appendix J)
Avoided Treatment Costs - P	kg-P/HH/year			$0	$0	$0	$0	$0	$0	Per DEP Stormwater Project Costs per kg (Appendix J)
Residual Value	$/system	1	$18,335	$18,335	$18,335	$18,335	$18,335	$18,335	$18,335	30 yrs Residual Value
		Direct Benefits Sub-Total:		$111,853	$93,338	$80,299	$73,905	$62,903	$55,155	
			Benefit							
Non-Market Benefits	**Units**	**Quantity**	**One Time/ Annual Value**	**Total Benefit 4%**	**Total Benefit 7%**	**Total Benefit 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
WTP for Surface Water Quality / Clarity	$/HH	1	$3	$49	$39	$33	$49	$39	$33	EPA
WTP for Ground Water Quality	$/HH	1	$7	$93	$74	$61	$93	$74	$61	
Community values (aesthetics, recreation & springs tourism)	$/person	2.43	$32	$1,113	$893	$737	$1,113	$893	$737	
		Non-Market Benefits Sub-Total:		$1,255	$1,006	$831	$1,255	$1,006	$831	
		Benefits Total:		$113,108	$94,344	$81,130	$75,160	$63,909	$55,986	

Results

Net Benefits:		$51,254	$36,355	$25,863	$27,021	$18,240	$12,055	
Benefit:Cost Ratio:		1.83	1.63	1.47	1.56	1.40	1.27	
Net present value per dollar of capital outlay								

Benefit:Cost Analysis Summary

Alternative 3b: Central WWT w/ Lift Station

			20 Year Horizon							
			Cost							
Direct Costs	**Units**	**Quantity**	**One Time/ Annual Cost**	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
Land Costs	$ / system	-	$0	$0	$0	$0	$0	$0	$0	Use of existing ROW assumed
Design & Permitting Costs	$ / system	1	$100	$100	$100	$100	-$510	-$510	-$510	Plumbing Permit for lateral
System Purchase (CAPEX)	$ / system	1	$29,771	$29,771	$29,771	$29,771	$23,716	$23,716	$23,716	Pressured Collection System; Lift Stations
Installation / Connection	$ / system	1	$11,775	$13,541	$13,541	$13,541	$13,541	$13,541	$13,541	Individual Laterals, plus outside city limit City System Charge ($4500) and Tap Location fee ($275); Section 2.3.6 and 2.3.7
O&M / Repair (OPEX)	$ / year		$0	$0	$0	$0	-$1,611	-$1,292	-$1,068	
System / Utility Rates*	$ / year	1	$1,381	$19,519	$15,654	$12,933	$19,519	$15,654	$12,933	Outside the city limits the City of Tallahassee's current monthly rates include $30.14 customer charges plus $0.944 per 100 gallons. Using the 300 gallons per household per day benchmark, the variable cost is $84.96 per month; total costs are $115.10 per month or $1,381 per year).
Replacement (Life-Cycle)	$ / year	0	$0	$0	$0	$0	-$5,300	-$4,251	-$3,512	Included in System Charges
		Direct Cost Sub-Total:		$62,931	$59,067	$56,345	$49,355	$46,859	$45,101	
			Cost							
Indirect Costs	**Units**	**Quantity**	**One Time/ Annual Cost**	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
Compliance Penalties (DEP)	$ / year	-		$0	$0	$0	$0	$0	$0	Per DEP, no fines are expected to be imposed; compliance via consent order
		Indirect Cost Sub-Total:		$0	$0	$0	$0	$0	$0	
			Cost							
Non-Market Costs	**Units**	**Quantity**	**One Time/ Annual Cost**	**Total Cost 4%**	**Total Cost 7%**	**Total Cost 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
Shadow Price of Nutrient Pollution	$ / yr			$0	$0	$0	$0	$0	$0	
Water-borne Disease (potable well contamination)	occurrences/HH/yr	-	$3,952	$0	$0	$0	-$93	-$75	-$62	
Diminished Springs Tourism and other Recreation	$/HH/year	1	$0.16	$2	$2	$2	-$44	-$35	-$29	Central Residual as Percent of Conventional
		Non-Market Cost Sub-Total:		$2	$2	$2	-$137	-$110	-$91	
		Costs Total:		$62,934	$59,069	$56,347	$49,218	$46,749	$45,010	
			Benefit							
Direct Benefits	**Units**	**Quantity**	**One Time/ Annual Value**	**Total Benefit 4%**	**Total Benefit 7%**	**Total Benefit 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
Grants; State/Federal Funds	$/system			$0	$0	$0	$0	$0	$0	
Property Value Enhancement	$/lot		$0	$0	$0	$0	$0	$0	$0	Per Leon County Property Appraiser, there is no evidence of increased value associated with central treatment
Ad Valorem	$/year		$0	$0	$0	$0	$0	$0	$0	No increment in ad valorem
Utility Revenues	$ / year	1	$1,381	$19,519	$15,654	$12,933	$19,519	$15,654	$12,933	City of Tallahassee
Avoided Treatment Costs - N	kg-N/HH/year	9.69	$541	$74,000	$59,349	$49,031	$36,051	$28,913	$23,887	Per DEP Stormwater Project Costs per kg (Appendix J)
Avoided Treatment Costs - P	kg-P/HH/year			$0	$0	$0	$0	$0	$0	Per DEP Stormwater Project Costs per kg (Appendix J)
Residual Value	$/system	1	$17,863	$17,863	$17,863	$17,863	$17,863	$17,863	$17,863	30 yrs Residual Value
		Direct Benefits Sub-Total:		$111,381	$92,866	$79,827	$73,433	$62,431	$54,682	
			Benefit							
Non-Market Benefits	**Units**	**Quantity**	**One Time/ Annual Value**	**Total Benefit 4%**	**Total Benefit 7%**	**Total Benefit 10%**	**Relative to Base Case 4%**	**Relative to Base Case 7%**	**Relative to Base Case 10%**	**Comments**
WTP for Surface Water Quality / Clarity	$/HH	1	$3	$49	$39	$33	$49	$39	$33	EPA
WTP for Ground Water Quality	$/HH	1	$7	$93	$74	$61	$93	$74	$61	
Community values (aesthetics, recreation & springs tourism)	$/person	2.43	$32	$1,113	$893	$737	$1,113	$893	$737	
		Non-Market Benefits Sub-Total:		$1,255	$1,006	$831	$1,255	$1,006	$831	
		Benefits Total:		$112,636	$93,872	$80,658	$74,688	$63,437	$55,514	

Results								
Net Benefits:		$49,703	$34,804	$24,311	$25,470	$16,688	$10,504	
Benefit:Cost Ratio:		1.79	1.59	1.43	1.52	1.36	1.23	
Net present value per dollar of capital outlay								

Note to Appendix H.

The benefit-cost analysis summaries comprising Appendix H are the output tables from an Excel workbook that includes references, original source values, adjustment factors for the dates of source data (i.e., using the Consumer Price Index), and factors for inflation and discounting across the study planning horizon (20 years). The entire workbook is included among the deliverables to Leon County. Comments provided in the individual project alternatives refer to supporting material in other tabs in the workbook and explain any adjustments to the calculations.

Appendix I Considerations for Responsible Management Entities (RMEs).*

Typical Applications	Program Description	Benefits	Limitations
Model 1 - Homeowner Awareness Model			
• Areas of low environmental sensitivity where sites are suitable for conventional onsite systems.	• Systems properly sited and constructed based on prescribed criteria. • Owners made aware of maintenance needs through reminders. • Inventory of all systems.	• Code-compliant system. • Ease of implementation; based on existing, prescriptive system design and site criteria. • Provides an inventory of systems that is useful in system tracking and area-wide planning.	• No compliance/problem identification mechanism. • Sites must meet siting requirements. • Cost to maintain database and owner education program.
Model 2 - Maintenance Contract Model			
• Areas of low to moderate environmental sensitivity where sites are marginally suitable for conventional onsite systems due to small lots, shallow soils, or low permeability soils. • Small clustered systems.	• Systems properly sited and constructed. • More complex treatment options, including mechanical components or small clusters of homes. • Requires service contracts to be maintained. • Inventory of all systems. • Service contract tracking system.	• Reduces the risk of treatment system malfunctions. • Protects homeowner investment.	• Difficulty in tracking and enforcing compliance because it must rely on the owner or contractor to report a lapse in a valid contract for services. • No mechanism provided to assess effectiveness of maintenance program.
Model 3 - Operating Permit Model			
• Areas of moderate environmental sensitivity such as wellhead or source water protection zones, shellfish growing waters, or swimming/water contact recreation. • Systems treating high-strength wastes or large-capacity systems.	• Establishes system performance and monitoring requirements. • Allows engineered designs but may provide prescriptive designs for specific receiving environments. • Regulatory oversight by issuing renewable operating permits that may be revoked for noncompliance. • Inventory of all systems. • Tracking system for operating permit and compliance monitoring. • Minimum for large-capacity systems.	• Allows systems in more environmentally sensitive areas. • Operating permit requires regular compliance monitoring reports. • Identifies noncompliant systems and initiates corrective actions. • Decreases need for regulation of large systems. • Protects homeowner investment.	• Higher level of expertise and resources for regulatory authority to implement. • Requires permit tracking system. • Regulatory authority needs enforcement powers.
Model 4 - Responsible Management Entity (RME) Operation and Maintenance Model			
• Areas of moderate to high environmental sensitivity where reliable and sustainable system O&M is required, e.g., sole-source aquifers, wellhead or source water protection zones, critical aquatic habitats, or outstanding value resource waters. • Clustered systems.	• Establishes system performance and monitoring requirements. • Professional O&M services through RME (either public or private). • Provides regulatory oversight by issuing operating or NPDES permits directly to the RME. (System ownership remains with the property owner). • Inventory of all systems. • Tracking system for operating permit and compliance monitoring.	• O&M responsibility transferred from the system owner to a professional RME that is the holder of the operating permit. • Identifies problems needing attention before failures occur. • Allows use of onsite treatment in more environmentally sensitive areas or for treatment of waste with relatively greater nutrient concentrations. • Can issue one permit for a group of systems. • Protects homeowner investment.	• Enabling legislation may be necessary to allow RME to hold operating permit for an individual system owner. • RME must have owner approval for repairs; may be conflict if performance problems are identified and not corrected. • Need for easement/right of entry. • Need for oversight of RME by regulatory authority.

Typical Applications	Program Description	Benefits	Limitations
Model 5 - Responsible Management Entity (RME) Ownership Model			
• Areas of greatest environmental sensitivity where reliable management is required. Includes sole-source aquifers, wellhead or source water protection zones, critical aquatic habitats, or outstanding value resource waters. • Preferred management program for clustered systems serving multiple properties under different ownership (e.g., subdivisions).	• Establishes system performance and monitoring requirements. • Professional management of all aspects of decentralized systems through public/private RMEs that own or manage individual systems. • Qualified, trained, owners and licensed professional owners/operators. • Provides regulatory oversight by issuing operating or NPDES permit. • Inventory of all systems. • Tracking system for operating permit and compliance monitoring.	• High level of oversight if system performance problems occur. • Simulates model of central sewer, reducing the risk of noncompliance. • Allows use of onsite treatment in more environmentally sensitive areas. • Allows effective area-wide planning/watershed management. • Removes potential conflicts between the user and RME. • Greatest protection of environmental resources and owner investment.	• Enabling legislation and/or formation of special district may be required. • May require greater financial investment by RME for installation and/or purchase of existing systems or components. • Need for oversight of RME by regulatory authority. • Private RMEs may limit competition. • Homeowner associations may not have adequate authority.

Source: USEPA, 2003, "*Voluntary National Guidelines for Management of Onsite and Clustered (Decentralized) Wastewater Treatment Systems"*

* *Based on a 1990s inter-agency assessment of applicability of alternative wastewater treatment systems for Leon County and the Wakulla Springs area (DEP in concert with TLCPD, Leon County Health Unit and Leon County Growth and Environmental Management Department – now Development Support and Environmental Management), Model 4 and Model 5 (RMEs) were considered appropriate for achieving desired treatment standards, but challenges of implementation (including billing, Health Department permitting constraints, and regulatory oversight) were recognized. Further research into the use of RMEs was not pursued as part of this current project.*

Appendix J Nutrient Removal Costs

Grant Number	Contractor	Total Project Cost	TN Reduction lb/yr	TN Cost lb/yr	TN Cost lb/yr/acre	TP Reduction lb/yr	TP Cost lb/yr	TP Cost lb/yr/acre
G0053	Titusville, City of	$1,655,169	1014.2	$1,631.99	$14.32	145.2	$11,399.24	$99.99
G0287	City of Palatka	$360,000	796.4	$452.03	$1.13	187	$1,925.13	$4.82
LP6779 A2	City of Ocala	$2,536,248	3995.2	$634.82	$0.86	649	$3,907.93	$5.29
S0096	Lee County	$2,194,520	4191	$523.63	$0.07	220	$9,975.09	$1.26
S0097	Escambia County	$701,833	470.8	$1,490.72	$1.08	473	$1,483.79	$1.08
S0098	Walton County	$265,836	105.6	$2,517.39	$68.04	26.4	$10,069.55	$272.15
S0162	Maitland, City of	$2,586,301	237.6	$10,885.11	$90.11	228.8	$11,303.76	$93.57
S0163	Seminole County	$3,019,227	1606	$1,879.97	$3.63	147.4	$20,483.22	$39.50
S0190	Lake Worth	$1,000,000	2635.6	$379.42	$1.36	83.6	$11,961.72	$42.72
S0191	Lake County Water Authority	$1,628,699	501.6	$3,247.01	$120.26	77	$21,151.94	$783.41
S0192	Ocoee, City of	$2,600,000	413.6	$6,286.27	$50.70	63.8	$40,752.35	$328.65
S0238	Winter Park, City of	$1,364,000	574.2	$2,375.48	$25.01	57.2	$23,846.15	$251.01
S0239	Port St. Lucie, City of	$1,822,000	4083.2	$446.22	$1.83	1430	$1,274.13	$5.22
S0257	Martin County	$2,902,518	286	$10,148.66	$94.85	90.2	$32,178.69	$300.74
S0261	Seminole County	$7,875,190	1133	$6,950.74	$2.48	200.2	$39,336.61	$14.04
S0262	Deltona, City of	$2,227,448	481.8	$4,623.18	$10.75	167.2	$13,322.06	$30.98
S0263	Leesburg, City of	$1,429,000	380.6	$3,754.60	$28.36	132	$10,825.76	$81.77
S0267	Pinellas County	$2,990,533	2761	$1,083.13	$1.18	871.2	$3,432.66	$3.73
S0269	Lake County	$311,000	501.6	$620.02	$14.76	77	$4,038.96	$96.17
S0271	Jacksonville, City of	$4,384,800	60585.8	$72.37	$0.05	545.6	$8,036.66	$5.32
S0278	Stuart, City of	$1,758,008	937.2	$1,875.81	$6.92	382.8	$4,592.50	$16.95
S0284	Marian County	$1,873,500	453.2	$4,133.94	$13.92	48.4	$38,708.68	$130.33
S0285	Rockledge, City of	$931,500	4122.8	$225.94	$0.33	752.4	$1,238.04	$1.81
S0286	Gulfport, City of	$1,290,715	178.2	$7,243.07	$125.97	63.8	$20,230.64	$351.81
S0309	Port Orange, City of	$4,000,000	827.2	$4,835.59	$2.81	272.8	$14,662.76	$8.52
S0314	Winter Garden, City of	$3,075,127	2987.6	$1,029.30	$1.87	671	$4,582.90	$8.35
S0317	Sarasota, City of	$16,873,000	1507	$11,196.42	$2.82	723.8	$23,311.69	$5.87
S0319	Ocoee Public Work, City of	$2,800,000	156.2	$17,925.74	$239.01	167.2	$16,746.41	$223.29
S0338	City of Titusville	$1,563,126	48.4	$32,295.99	$58.29	146.3	$10,684.39	$19.28
S0340	Tavares, City of	$7,400,000	69040.4	$107.18	*	10494	$705.16	*
S0361	Martin County Office of Wa	$6,825,000	1326.6	$5,144.73	$9.53	198	$34,469.70	$63.83
S0363	Martin County Office of Wa	$788,000	167.2	$4,712.92	$27.84	83.6	$9,425.84	$55.68
S0374	Town of Surfside	$1,747,000	1285.24	$1,359.28	$10.31	166.32	$10,503.85	$79.70
S0376	Atlantic Beach	$2,075,806	81.4	$25,501.30	$468.77	41.8	$49,660.43	$912.88
S0387	City of South Daytona	$4,417,977	226.6	$19,496.81	$40.96	83.6	$52,846.61	$111.02
S0434	City of Maitland	$1,098,365	37.4	$29,368.05	$1,446.70	8.14	$134,934.28	$6,647.01
S0435	Lake County Public Works	$2,340,000	596.2	$3,924.86	$31.27	107.8	$21,706.86	$172.96
S0436	SJRWMD	$3,000,000	33092.4	$90.66	$0.01	9504	$315.66	$0.04
S0439	Brevard County of Office R	$1,600,000	12.76	$125,391.85	$663.45	3.3	$484,848.48	$2,565.34
S0472	Lake County	$1,578,463	215.6	$7,321.26	$157.79	37.4	$42,204.89	$909.59

* Denotes "Not Applicable"
SJRWMD = St. Johns River Water Management District

Source: http://baysoundings.com/the-real-cost-of-fertilizer/#:~:text=The%20average%20cost%20to%20remove, Florida%20Department%20of%20Environmental%20Protection.